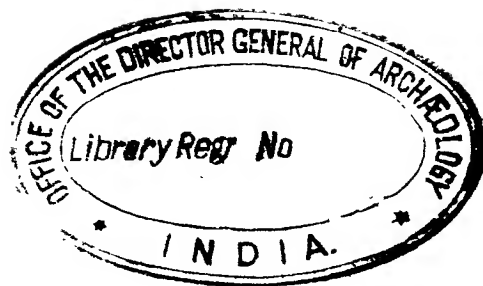


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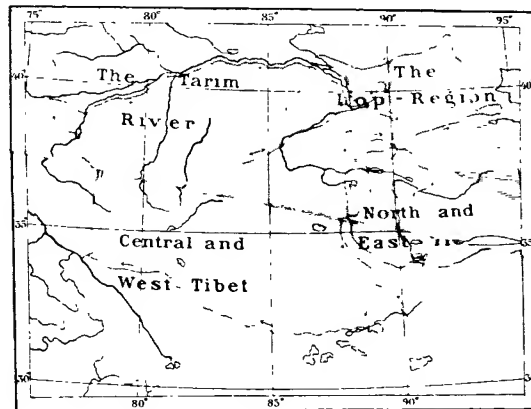
1899—1902

VOL. III

NORTH AND EAST TIBET

BY

DR SVEN HEDIN



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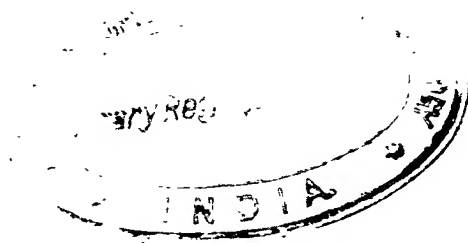
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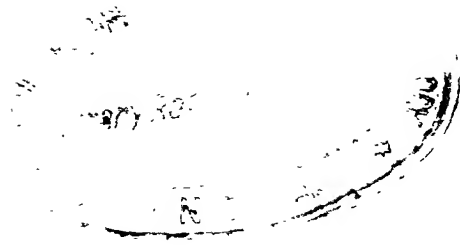
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# MY FIRST JOURNEY IN NORTH- EASTERN TIBET









## CHAPTER I.

### OVER THE ASTIN-TAGH.

On the 30th June in the year 1900 I left Jurt-tschapghan intending to travel, via Abdal and Kum-tschapghan, to the southern shore of the Kara-koschun, and from there to the well of Dunglik. This, the first day's march, which belongs to the lake area, has been already described. I shall still continue to adhere to the plan

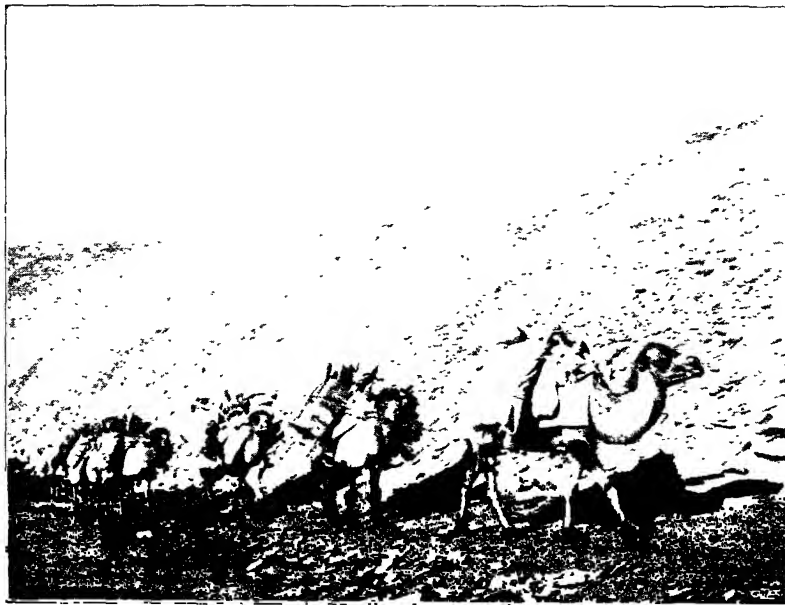


Fig. 1. ON THE ROAD TO TIBET.

which I have hitherto followed, of describing and discussing day by day the physical geography of the country travelled through, as well as jotting down the observations I made each day. I advance no claims to be a specialist in geology, and shall therefore content myself with brief indications of the dip of the strata and the macroscopic features of the mountains. The rock specimens that I collected will be dealt with by expert geologists in a separate section of the work. My descriptive text will still continue to form a faithful running commentary upon the map; and after the

several itineraries have been described, I shall, by way of a finish to the whole, give a general view of the geographical and hypsometrical relations of the high plateau-land of Tibet.

On the 2nd July we covered the long and tiring stage which reaches from Dunglik to Tatlik-bulak. No sooner did we leave behind the sharply drawn boundary of the narrow belt of scanty vegetation than we found ourselves on the absolutely barren saj that slopes gently up towards the foot of the mountains, the surface being hard, with coarse sand and thin gravel, but without the slightest trace of organic life, either old or new. The gad-flies, which are a veritable plague to both man and beast throughout the whole of the Lop country, disappeared as if by magic, and it was with a sense of intense relief that we no longer heard the unceasing drone and buzz of these insects. On our left the belt of vegetation gradually thinned out to a point; we were travelling away from it at an acute angle. Although the atmosphere was perfectly clear, all we saw of the lake of Kara-koschun and its kamisch was simply a thin, dark, horizontal line, backed by a faint, low-lying haze, which by its yellow tint betrayed that it was meant for dunes.

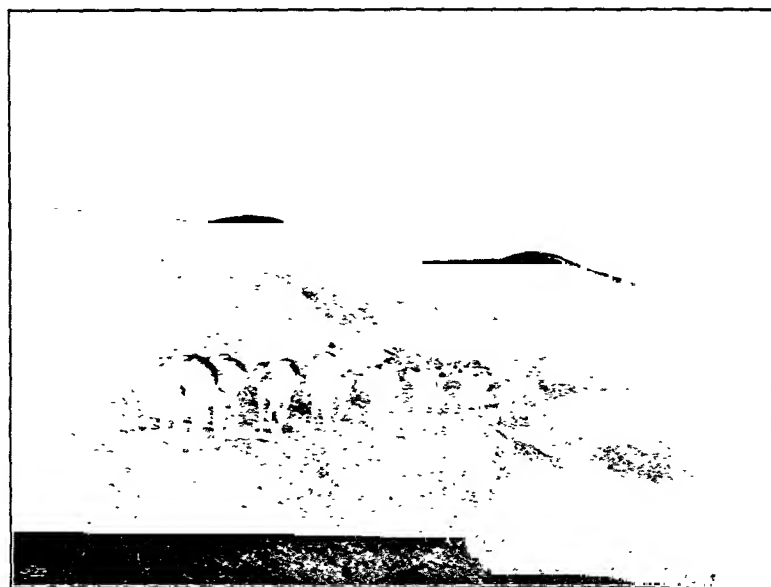


Fig. 2. NOT FAR FROM HUNGLUGHU.

The part of the Astin-tagh which lay to the south of our route stood out distinctly, at first as a single range, but afterwards as two ranges. From the lowlands it was however impossible to make out its orographical structure. I took down the compass-bearings of four dominating peaks, the first three belonging apparently to the farther range, the fourth to the nearer range; this last was visible all day. The first broad, dry, slightly excavated erosion channel that we came across was the Asghanlik; it came from the S.  $30^{\circ}$  E. and disappeared in the N.  $30^{\circ}$  W. The second, much more deeply hollowed out, was the Julghunluk, and came from the S.  $32^{\circ}$  E. At the point where we crossed it, it was divided into three arms;

so that the water, upon reaching down as far as this after a violent rain in the mountains, spreads out in a sort of delta. It is very probable that the belt of vegetation, which at Dunglik grows on the border-line between the perfectly level ground of the former lake-bottom and the slowly ascending saj, owed its origin to temporary streams just like this. The water pretty certainly never gets beyond this belt of vegetation, but, gathering there, forms transient marshes; unquestionably it never gets down as far as the Kara-koschun.



Fig. 3. A HILL NEAR HUNGLUGHU.

At Julghunluk, and all the way up from that point, the scrubby plant *tschun-tschun* makes its appearance, though it occurs very sparsely throughout, except in the watercourses, where it is more abundant. At intervals the road is marked by small heaps or pyramids of stones; they do not indicate the distance, only the direction in which the road runs, for it is always difficult to follow these roads in a desert storm. But the half way between Dunglik and Tatlik-bulak is marked at a gentle swell by two pyramidal heaps of stones.

We next came to the eroded watercourse of Jan-bulak, a pretty big channel; and so too is the next one formed by the junction of the Toghrak-tschap and the Kosch-bulak. Both these streams appeared to issue from an imposing and dominating bluff of the Astin-tagh, to which belongs also the fourth of the up-standing mountain-peaks the compass-bearings of which I had already taken. But after that the appearance and the actual characteristics of the country underwent a change, for we entered in amongst the lowest foot-hills of the range. These consist of gravel-and-shingle, coarse sand on the top and fine, soft disintegrated material underneath, the gravel being firmly cemented in the soft material. We struck into a pretty distinct, but dry, glen. At its entrance there was a light green schist, dipping  $70^{\circ}$  towards the S.  $15^{\circ}$  W., and after that came a hard, dark schist at  $80^{\circ}$

towards the N.  $25^{\circ}$  W. The former, which was only exposed at a few places, was excessively weathered, and crumbled to pieces at a touch.

We followed the glen in its upward ascent. From both sides it is joined by smaller glens and ravines, and the sculpturing of the rain-torrents, which we seldom



Fig. 4. BIG TAMARISKS IN THE VALLEY OF TATLIK-BULAK.

saw, and which were then absolutely dry, imparted an increasingly rugged aspect to the mountain scenery. The track ran up and down over the hills, ridges, and side-spurs of every shape and size, all built up of the same soft material and furrowed by thousands upon thousands of dry torrents. Here too the dark green schist predominates, though it only crops out at the points where the sides of the watercourses

have been exposed through the erosive action of the rain-water. South of our route rose a crest of the same dark rock. Upon emerging from a little ravine, the glen widens out and forms the oasis of Hunglughu, with the Hunglughu-darja, a bright and beautiful little brook, on the west side of which the Chinese have built a hut



Fig. 5. BIG TAMARISKS IN THE VALLEY OF TATLIK-BULAK.

or caravanserai, though it is now unoccupied. Thanks to this copious and uninterrupted supply of water, the little oasis supports what, in comparison with the barren desert from which we had lately come, may be called a luxuriant vegetation. Fine, vigorous tamarisks grow on the level ground, i. e. without the usual mounds, while the landscape is further enlivened by *kamisch*, *tschige*, and other plants. In an ex-

pansion of the glen on the right side of the stream there stand a dozen old gnarled toghraks. At Hunglughu the dark rock forms on both sides a pretty solid mass, pierced by fissures. Otherwise the mountains are built up of soft material. Close to the left side of the brook stands the butte of Munar-dung, composed of hard gravel-and-shingle. The nearest glen-wall consists of a hard, reddish rock, probably granite, cropping out in knobs and bosses, without stratification. Near to Tatlik-bulak and a little way up the glen there occurs a very hard rock, dark and coarsely crystalline, without any distinct dip, but with veins permeating it in all directions, the cleavages in which have given rise to deep disintegration. On the right-hand side of the glen this rock forms a steep and sharply accentuated wall.

As we proceeded farther up the glen, the brook gradually grew fuller of body, and at Tatlik-bulak it hugs closely the foot of the cliffs on the right-hand side. The water was slightly muddy, and had a scarce perceptible percentage of salt. At 9 p. m. its temperature was  $12.8^{\circ}$  C., while that of the air was  $20^{\circ}$ . The brook, the source of which we were to reach on the following day, is lost amongst the disintegrated gravel not far below Hunglughu. Parallel to the glen of Tatlik-bulak there is said to be a broad, level, waterless glen called Kurghaning-chaltasi, coming down between the spurs whose extremities we passed and the range in which the peak D is situated.

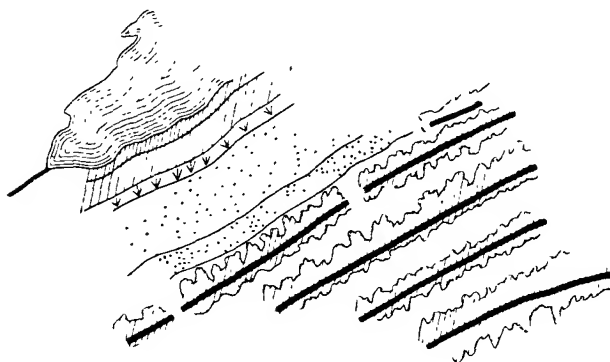


Fig. 6.

The spot where we made Camp. No. II derives its name of Tatlik-bulak\*, or the Fresh Spring, from a small spring which gushes out of the perpendicular gravel-and-shingle cliff on the left-hand side of the glen. Its water was perfectly fresh and as clear as crystal, and had a temperature of exactly  $10^{\circ}$  C. The little rivulet it forms soon unites with the glen brook. The top of the gravel-and-shingle terrace is crowned by a cairn of stones and a couple of poles bearing the inscriptions -- »P. Splingaert, 1894«, and »C. E. Bonin, 1899«. A little way higher up there are some poplars standing in a crevice of the rocks. Although the species were few, the vegetation as a whole was tolerably abundant; in the rivulet from the spring I observed a species of *Algae* and a succulent kind of moss. Immediately below the spring the tamarisks form a luxuriant and shady grove. Of animal life, I noticed some small birds, ants, spiders, flies, ticks, and beetles, though their numbers were few. At one spot where we measured it, the brook was 1.54 m. broad, had a mean

\* Generally incorrectly pronounced as Taltik-bulak.

depth of 0.13 m., and a mean velocity of 0.92 m. in the second. Its volume amounted to 0.184 cub.m. in the second; of this amount barely one-tenth came from the little spring, but as the rest of the water was spring-water too, the volume at that season is no doubt pretty constant. We found however that, in places where the glen contracts to widths varying from 40 to 150 m., it is sometimes filled with water from side to side; this happens of course after showers in the regions higher up. The springs flow all the year round, and consequently in winter thick and extensive sheets of ice are formed here, as in so many other places, until they almost fill the bottom of the valley. The Mongol caravans therefore, when on the way to Lhasa, avoid this route, because their camels are unable to travel on the slippery ice; but with shod horses travelling is quite easy.

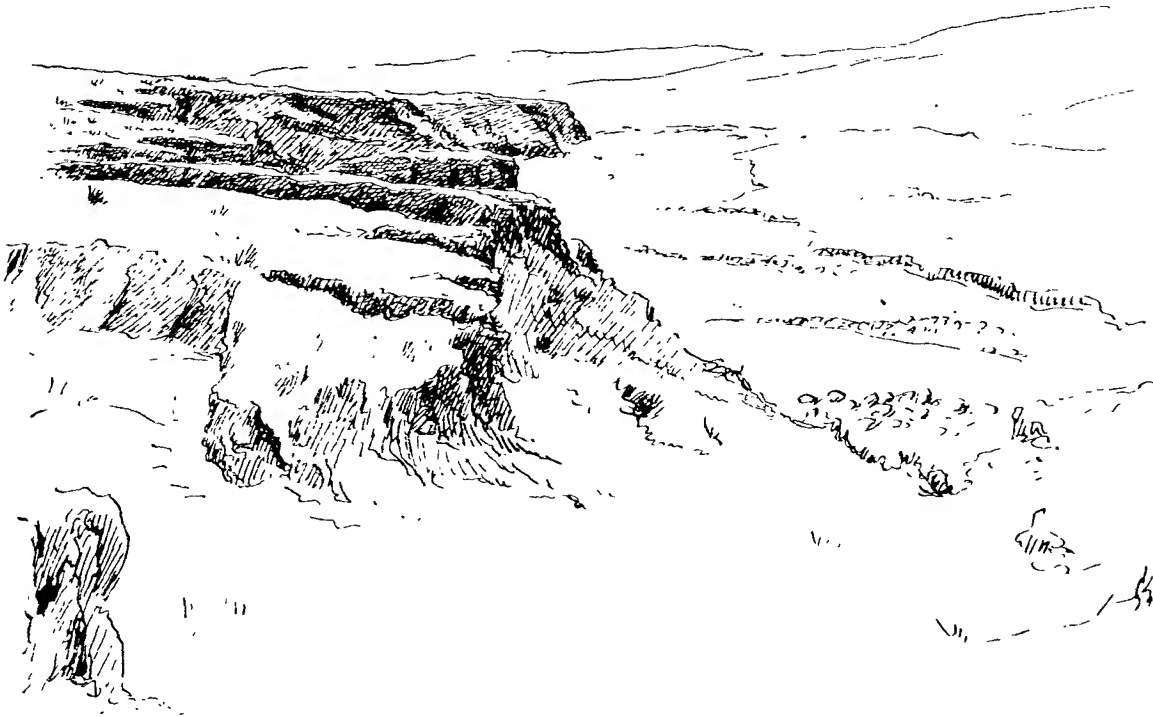


Fig. 7. THE LEFT TERRACE OF THE RIVER-BED OF ARPA-SAJ.

On our way from the Kara-koschun to the entrance to the glen of Tatlik-bulak, we had thus crossed successively the following zones (see fig. 6) — (1) next the lake, a narrow strip of sedimentary mud, barren saliferous soil, which had been under water during the last preceding high-water period — a strip which becomes perfectly dry during the summer and is again moistened by the autumn flood. (2) This is followed by a broader belt of the same formation, schor, but rough, dry, and full of holes. (3) The vegetation zone of Dunglik, which is continued westwards past Asghanlik, Kar-bulak, Jajlik-saj, Kona-bulak, Julghunlik-saj, Avras, Miän (Muran), Tscharklik, Jaka-toghrak, Vasch-schahri, etc. as far as the district of Nija. For this very reason it is impossible to regard the eastern section of this belt of vegetation, as some have done, as being a shore-line, marking the limits of the former extension of the Kara-koschun. (4) The saj, often called *kakir*, then slopes slowly, though



quite perceptibly, upwards; it is but seldom broken, and presents a view of boundless extent in every direction. The countless shallow watercourses which traverse it no doubt often change their positions, and in that way help to level it down, and to distribute regularly and evenly the products of disintegration, sand and gravel, over the surface of this extensive talus of detritus, which stretches a long way to the east, and which I have crossed many times in the west, beginning at Chotan. On the whole it preserves the same uniform character throughout its entire length, and thus forms a transition between the mountains and the desert. Very different from these shallow watercourses are the exceedingly deep and energetically excavated tunnel-like channels which have carved their way down through the masses of gravel-and-shingle farther to the west, for instance the Möldscha, Bostan-toghrak, and Tollan-

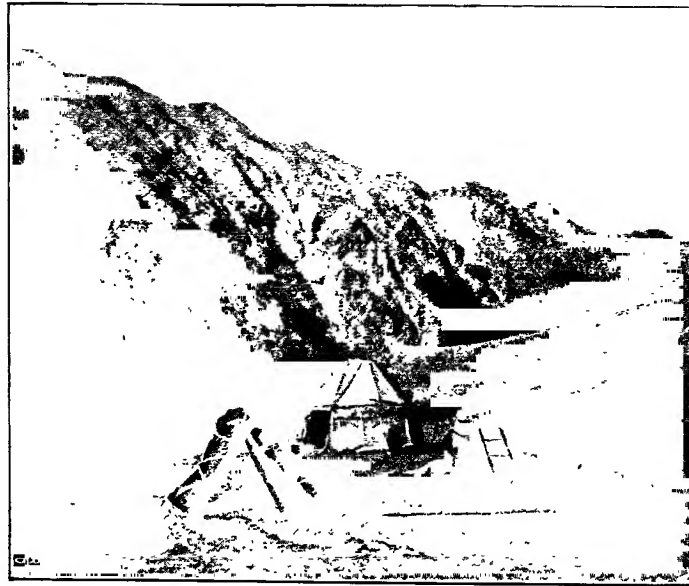


Fig. 8. MY CAMP AT TATLIK-BULAK.

chodscha (see fig. 197, vol. II), and in general all the waterways of the Kirk-saj. Arpa-saj, of which I append an illustration (fig. 7), is in this respect peculiar; for while its left side is formed by a deep terrace of gravel-and-shingle, its right side is flat. I have already called attention to the fact, that the streams which flow down off the northern slopes of the Kwen-lun grow increasingly larger from east to west, from the little glen of Tatlik-bulak to the immense valley of the Jarkent-darja. The same thing holds good of these channels tunnelled through the detritus slope, at any rate as far west as the Tollan-chodscha. In both cases the increase is dependent upon the height, conformation, and situation of the mountains and upon the precipitation. In the vicinity of the Kara-koschun the largest stream is the Tscharklik-su, yet it never gets all the way down to the lake; we shall however return to this stream lower down. The altitude of Kum-tschapghan is 817 m., of Dunglik 882 m., and of Tatlik-bulak 1,953 m. Thus in the course of our first day's journey we ascended not less than 1,071 m., and consequently travelled from the lowlands, with their warm, heavy, stifling atmosphere, to the cool light pure air of the mountains.

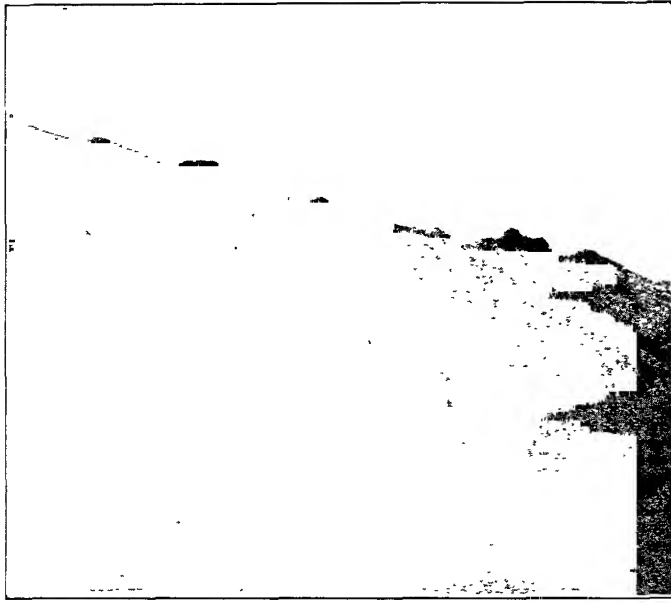


Fig. 9. THE RIGHT SIDE OF THE VALLEY SEEN FROM THE SPRING OF TATLIK-BULAK.

July 4th. Although the peak D is visible from Tatlik-bulak to the S. 11° W., it shortly afterwards becomes masked by the summits on the left side of the glen. The track runs up the glen, keeping close beside the little brook, and crossing it repeatedly. As we advanced, the brook appeared to grow gradually less, the reason being that it is fed lower down by invisible springs. Its salty taste became therefore rather more distinct as we got higher up, though we were always able to drink it. The floor of the glen rises slowly, but steadily, and is abundantly strewn with gravel. Vegetation accompanied us all day, but thinned out somewhat as we ad-

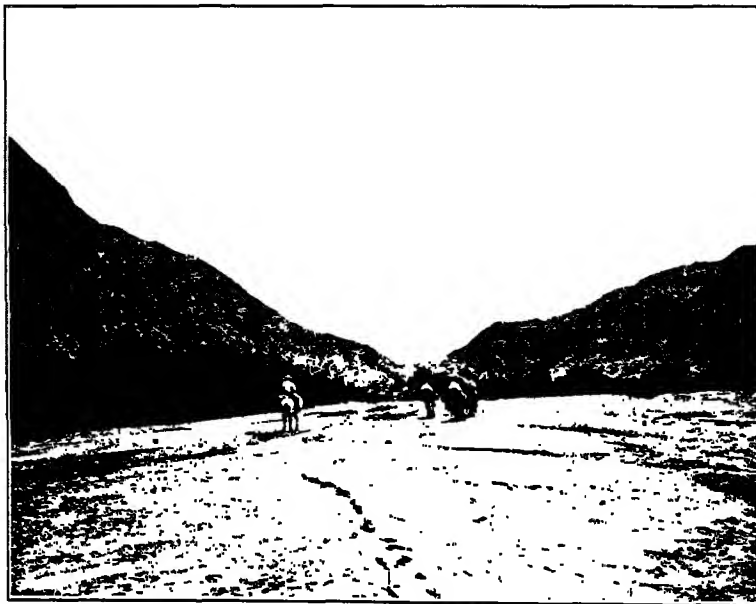


Fig. 10. A BROAD PLACE IN THE VALLEY OF TATLIK-BULAK.

vanced; it is only at the narrower places that it is poor or lacking altogether. It consists for the most part of magnificent tamarisks, which were then in full bloom, and of green and sappy kamisch. Immediately above Tatlik-bulak there is a small group of toghraks; between two of them were some poles set up so as to make a

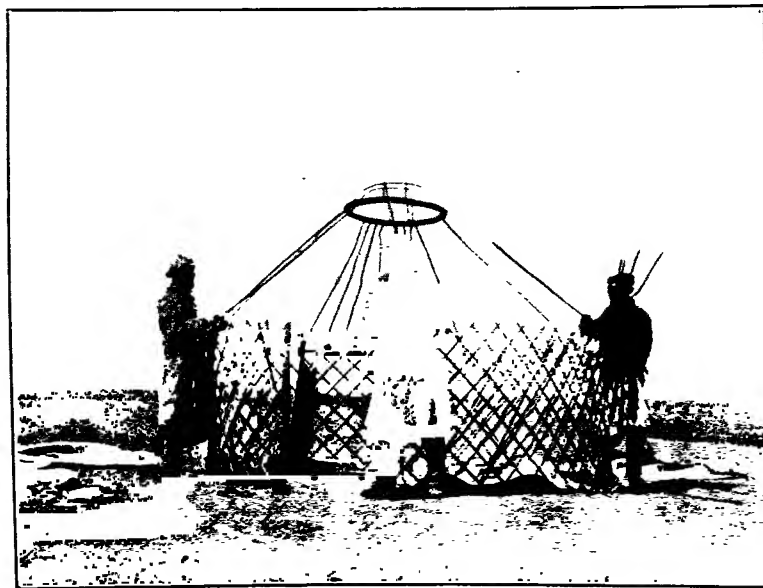
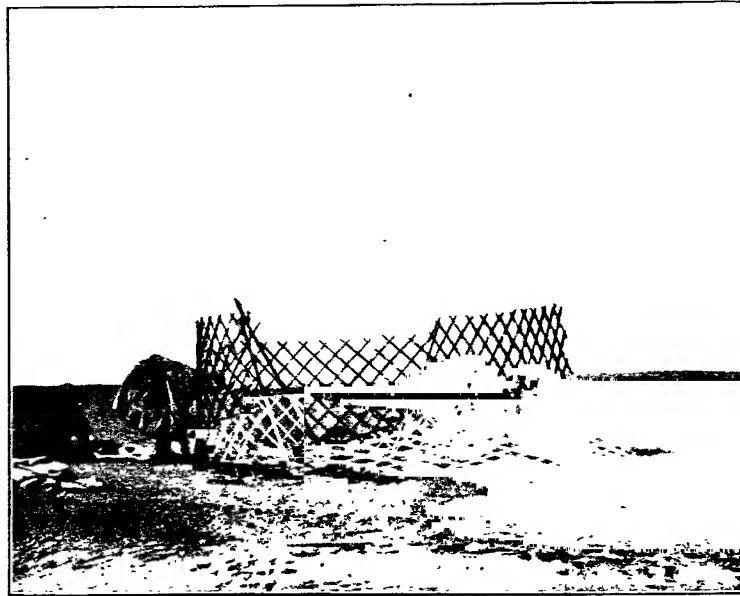


Fig. II. CONSTRUCTION OF MY MONGOL TENT.

raised platform (*saldam*), said to have been erected by the wild-camel hunters upon which to protect their booty against their dogs and against wild animals. But wild-camel never show themselves in this glen now. As a rule hard rock predominates on the right side of the glen and softer formations on the left. The transition from the steep mountain-sides to the level, water-worn bottom of the glen is often effected

by means of gravel-and-shingle terraces having the hardness of conglomerate, and in their base the brook has in many places hollowed out small grottoes and arches in miniature. Along the foot of the solid rocks, and at varying heights above the bottom of the glen, generally 35 to 40 cm., there frequently occur dark lines, which

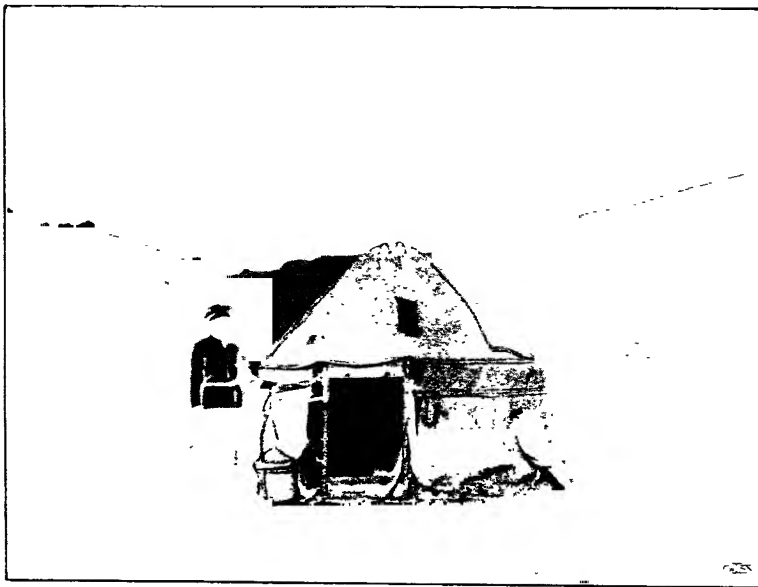
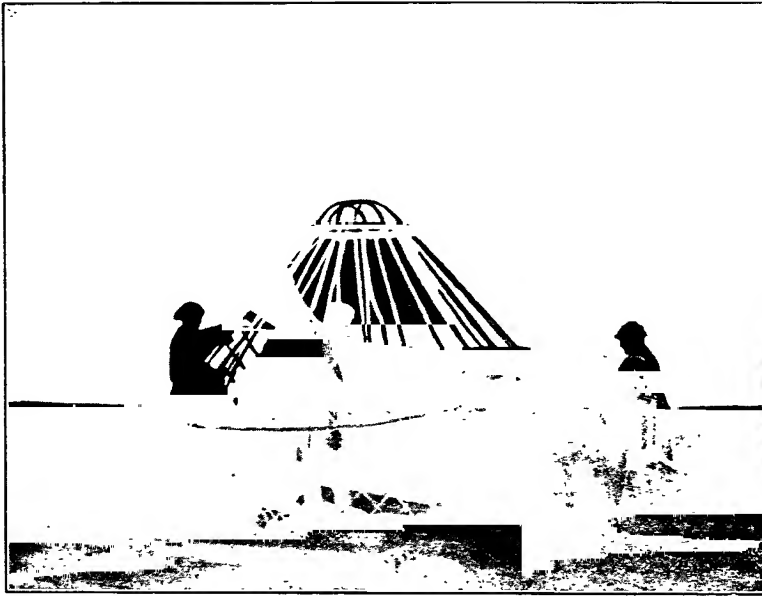


Fig. 12. CONSTRUCTION OF MY MONGOL TENT.

one is tempted to ascribe to the floods. But the accounts given me of the winter ice that forms in the glen make it more likely that these lines are caused either by the movement of the ice in spring or by its power of arresting disintegration through the exclusion of the atmosphere.

From the left there goes off a deeply trenched side-glen, Chaltaning-saji, which leads up to the pass in the spur that separates the glen of Tatlik-bulak (Prschevalskij calls it Kurghan-saj) from Kurghaning-chaltasi. The road over the range is said to be three times as long as the distance between Tasch-köl and Basch-kurghan. The vegetation in Kurghaning-chaltasi is poorer than that in our glen, and consists chiefly of tamarisks and steppe-plants. This glen is broad and level, but contains water only after rain.

At Toghraklik-tokaj there is a group of a dozen toghraks, young, slender trees, the last that grow in this direction. Next comes a side-glen, Kamisch-bulakning-ajaghi, leading up to the summits on the right side of the main glen; then, after bifurcating, it continues on to two small passes, from which a descent can be made on the north to Kamisch-bulak, a spring with fresh water, and a brook which probably courses down a glen of the same rank as that we were following, and more or less parallel with it. But the brook is reported not to descend very far before it disappears among the débris. This spring is surrounded, as the name indicates, by an abundance of kamisch. The upper part of the glen of Kamisch-bulak is called Buktu, and is said to be joined by a side-glen Buktaning-aghsi.

Opposite to Kamisch-bulakning-ajaghi the glen of Tatlik-bulak sends off a side-glen to the left, that is the south; this leads up to a pass, that conducts, by means of a foot-path, down to Kurghaning-chaltasi.

Hitherto we had travelled to the east, but now the glen inclined to the south-east. Out of the schistose rock on the left side of the glen a couple of tiny springs bubbled in one place; the water had a temperature of 8°, and was very slightly brackish. The sky was clouded until noon, and the air swarmed with small tire-some mosquitoes.

In a steep and small ravine (*jilgha*), Tasch-köl, on the right side of the glen, a little pool, a so called *stone lake*, only a few square meters in extent, is wont to form after rain, though it was then perfectly dry; evidently it had not rained for a pretty long time. Immediately above Tasch-köl comes Buktaning-aghsi, a deeply trenched sideglen, which joins our glen from the right. It leads up to a pass close at hand, and forms a short cut to the road to Tung-chuan. Thus there are two small glens both bearing the name of Buktaning-aghsi both no doubt leading down from the same pass. A little higher up the long, narrow glen of Kurghan-saj, or Tatlik-bulak, comes to an end, and the country opens out at a spot where three water-courses meet from different directions, and then burst through the lower, northern chain of the Astin-tagh. To the south rises the other parallel chain, fairly imposing and extending on the whole from east to west.

Between Tatlik-bulak and Basch-kurghan I made the following geological observations. The cliff on the right side of the glen consisted almost the whole way of the same hard, dark, coarsely crystalline rock (probably granite) which I have already noted as occurring in the vicinity of Tatlik-bulak. This cliff or mountain wing itself forms a compact, sharply defined wall, of a reddish colour, with very steep slopes and a jagged, cliff-like summit. It does not rise very high above the bottom of the glen, so that the small spurs which project across it, the *coulisses* of the glen, are likewise steep and short, and the few side-ravines that exist have

also steep walls and are deeply cut into the face of the cliff; nor have they any vegetation except at their lower ends. The spur that shuts in the glen on the left\*, although just as energetically sculptured, is lower, has more rounded outlines, and is littered with detritus. It is also pierced by a larger number of side-glens, of which some, e. g. Chaltaning-saji, are pretty big. The principal glen ascends with a very gradual but regular slope. Seen in profile, the bottom of the glen makes a straight line with slight indentations, these being caused by the little brook which threads its way down it, generally divided into several rivulets winding amongst the gravel. Here and there small patches of vegetation, kamisch and tamarisks, dot the glen like islands; though generally the bushes and reeds keep to the sides, where they form »braidings» of varying breadth, often not more than two or three meters. Scarce anywhere is there at the foot of the cliffs a scree of detritus; the products of disintegration are evidently washed away by the successive floods that course down the glen and distribute the material evenly over its floor. A glen of

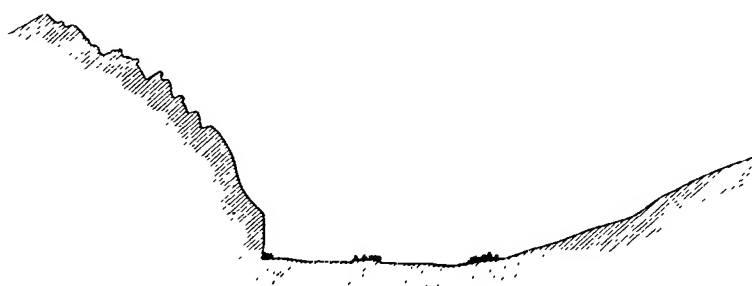


Fig. 13.

this type of structure can only occur in a region where the erosion is not constant. Did the brook flow for the greater part of the year it would give rise, on the one side of the glen or the other, to a deep and unchangeable channel at the foot of the cliffs, with the gravel-and-shingle terrace for one of its containing banks. Here however the erosive power of the brook is slight, at any rate infinitesimal as compared with the effect produced by the flood from a chance shower of rain. A flood of this kind, often a veritable torrent, fills the glen from side to side, and causes a complete rearrangement of the disintegrated detritus, filling up the channel of the constant spring-brook, so that it quite disappears and has to furrow out for itself a fresh path, which again is swept away by the next succeeding rain-torrent.

On the left, that is the southern, side of the glen the black schist was predominant all day; it lay at different angles, but as a rule was tilted up into an almost vertical position. At first it lay  $78^{\circ}$  towards the S.  $10^{\circ}$  W.,  $72^{\circ}$  towards the N.  $80^{\circ}$  W.,  $80^{\circ}$  towards the S.  $22^{\circ}$  E., and  $87^{\circ}$  towards the N.  $30^{\circ}$  W., all in the vicinity of Chaltaning-saji. At the point where the last observation was taken, a black schist cropped out also on the right side of the glen, though the rest of the

\* In speaking of the right and the left sides of a glen, I always suppose myself to be standing with my back towards the head or upper end of the glen and my face towards its lower end. Thus the right or the left side is always consistently the same, equally whether I am travelling up or down the glen.

rock there consisted, as I have already said, of coarsely crystalline red granite. As a rule the schist only crops out at the base of the slopes, where it has been exposed by the erosive torrents. Immediately below Toghraklik-saj the black schistose rock comes to an end, and is succeeded by red granite, which thus embraces both sides of the glen. Beyond the point just named, the rock is abundantly seamed with veins of pegmatite. Below Kamisch-bulakning-ajaghi there is on the left side of the glen first a green schist dipping  $71^{\circ}$  to the N.  $35^{\circ}$  E., and after that a hard, dark, finely crystalline variety of rock resembling diorite or diabase dipping  $81^{\circ}$  to the N.  $25^{\circ}$  W. Then, after a short interval of red granite, the schist reappears again. At the point last named there is on both sides a dark green schist dipping  $70^{\circ}$  to the N.  $20^{\circ}$  E.; but the crest of the cliff on the right appears to consist throughout of red granite. A little higher up the red granite supervenes again for a short distance, but is succeeded by the black schist on both sides. The schists out of which the little springs gush is dark, finely crystalline, and hard, and dips  $73^{\circ}$  to the N.  $30^{\circ}$  E. The hill on which the foot of Basch-kurghan stands consists of a rock that is fissured in every direction, with, to the south of it, a grey, coarsely crystalline rock greatly weathered, probably granite; while at the foot of the little hill there crops out an exceptionally hard variety of quartzite. The ridge which forms the southern continuation of this isolated eminence is however composed of soft material, although the mountains all round it are bare and naked rock.

The ruins of the fortified fort to which this place owes its name of Basch-kurghan, and which has also given rise to the name of Kurghan-saj, stand at the corner of the little eminence I have just mentioned. The wall, which was built of slabs of slate and sun-dried bricks, is best seen from below; on the hill itself it is hardly noticed, because it forms a sort of platform flush with the rock. On the north the hill-sides are very steep; but by the ridge before mentioned, which connects the eminence with the hills on the south, it can be ascended with ease. In fact the little eminence forms the extreme northern elevation or culminating point of these hills. On each side is an eroded watercourse, the two effecting a junction with a third that arrives from the south-east. The middle glen of the three leads up to Basch-jol, and it is this that we shall have to follow to reach Tschimen. The western glen, the brook of which provides good fresh water, in contradistinction to the other two, which are salt, stretches up towards the south-west, though afterwards it appears to turn to the west, round the bluff which contains the peak E. I was told, that it is a day's journey by this glen to Jan-bulak, the road thither running between the double range of the Tschokuluk-tagh on the south and the range with the peak E. on the north; this last is indeed the lower, northern chain of the two parallel chains of the Astin-tagh. About half-way to Jan-bulak, there is said to be a low flat ridge (*bel*) in the latitudinal valley, from which the water flows away in both directions after rain, eastwards to Basch-kurghan and Tatlik-bulak and westwards to Jan-bulak. Finally the eastern glen of the three I have mentioned climbs up S.  $60^{\circ}$  E., but later on bends to the east. It was along it that Littledale travelled when on his way to Tung-chuan and Sa-tscheo. The hills and terraces which rise on both sides of the lowest part of the middle glen are low and of pretty uniform height, giving the region an open appearance. The water does not begin to trickle out of the detritus

in the bottoms of the three glens until it reaches points a couple of hundred meters above Basch-kurghan, and consequently it is only there that the vegetation is at all vigorous, indeed on the margins of the brooks it is even quite thick, namely grass and kamisch; but it thins out rapidly as one advances up the dry glens, until there is nothing left except scanty scrub.



Fig. 14. LOOKING SOUTH-EAST FROM BASCH-KURGHAN.

That part of the main range of the Astin-tagh which we now had before us on the south is called the Tschokuluk-tagh. To the south-east of Basch-kurghan it forms an imposing mass, and has a salt spring at its northern foot, beside which nevertheless an abundance of reeds grow, known as Kamisch-bulak — not to be confounded with the spring of this same name that I have previously mentioned. Between Basch-kurghan and the spring just alluded to the ground rises by a series of low, rounded crests and ridges of soft material of a bright yellow colour. Above the spring (Kamisch-bulak) there are said to be two passes, Arkarlik-davan and Tschokuluk-tus-davan, which however are of no importance and are only used by hunters. All the water of this region, whether originating from rain-showers, or from the melting of the snows, or issuing from natural springs, flows down into the basin of the Kara-koschun, although, as I have said, it hardly ever gets down as far as the lake itself. Thus we had crossed the lowest chain of the Astin-tagh without climbing over any pass, only by traversing the breach of the transverse glen of the Kurghan-



saj. At the Anambaruin-gol we already encountered a similar glen, and have learnt that there too the Astin-tagh is a double range, the southern chain forming the water-divide, while the northern chain is pierced by the streams. If we were to trust solely to the map of this region drawn by the Russian General Staff, on the basis of Prschevskij's Fourth Journey, we should be unable to recognise the country. On that map the Astin-tagh is represented as a single large range; while the system really consists, as my maps clearly show, of two chains, separated from one another with the utmost distinctness, and presenting orographically very different characteristics. Even on Littledale's rough map it is easy to see, not only that there are two chains, but that one of them is the water-divide, while the other is pierced by the streams.

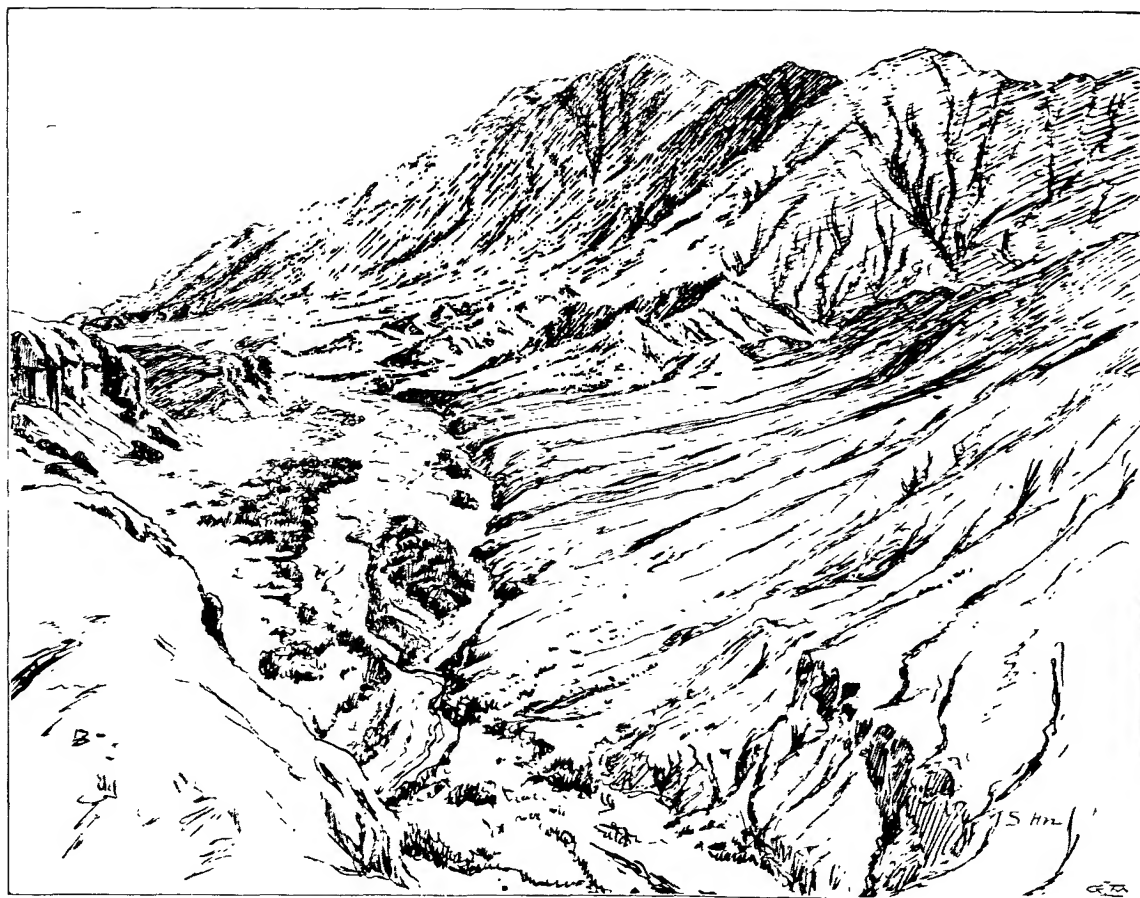


Fig. 15. LOOKING SOUTH-WEST FROM BASCH-KURGHAN.

The open and relatively flat country which extends between the lower Astin-tagh and the Tschokuluk-tagh, and is traversed by the three eroded watercourses already mentioned, thus forms a part of the great latitudinal valley which stretches a long way east and west between the two ranges named. It is evident that at some epoch in the past Basch-kurghan, or even the entrance to the glen of Tatlik-bulak, was once an important strategic point, owing to the fact of several streams and glens meeting there. The fort was of course intended to guard this important passage.

In the second volume of this work I have already quoted the names of the most important springs on the road to Tung-chuan. Another informant, who had travelled several times by that route, gave me the following additional information regarding it, and I accordingly add it as at once a check upon the statements in vol. II and as a supplement to them. The first spring is Dschan-bulak. Between it and Kosch-bulak the route crosses three pretty high passes in the great valley between the lower Astin-tagh and the Tschokuluk-tagh and the transverse glen of Satschkan-saj, which leads north to the Kara-koschun. Close to its entrance, or a day's journey from the road, water and kami-ch are to be had. The glen of Kosch-bulak yields fresh water and grazing, and unites with the Satschkan-saj. The Japkaklik-saj also penetrates to the north, and has in its lower part water and some grazing; it is joined by the Mus-saj from the east. One day's journey to the east of Kosch-bulak is Dscho-bulak, with water and grazing; it too slopes down towards the north, and is joined by the Guletschen glen to the east, which also possesses springs. From Dscho-bulak another day's journey will bring one to Tasch-köl, where the water collects in a rocky basin, though only after rain: there too the grazing is good. The road from the last-named to Kum-bulak, where there are both water and grazing, crosses over the Lower Astin-tagh. Then follows the glen of Chodscha-schukur, with water and grazing, it too sloping towards the north. Beyond it lie the Kara-davan, Jangisuni-saji, Arkarlik, and an unnamed spring without grazing, as well as a glen with salt water and grazing. Two days beyond Chodscha-schukur lies Toghrak-bulak, with water, grazing, and poplars.

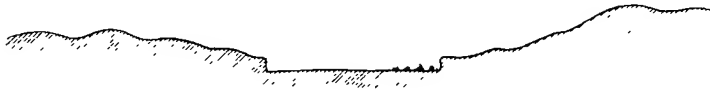


Fig. 16.

The following places, which occur on the road to Anambar, lie between the two chains of the Astin-tagh; I have myself visited them, and shall describe them in a subsequent chapter. Travelling from Anambar (Chan-ambal) you come successively to Tsching-to; Hollustu; Tömörtu, on the lowland below the mountains and consisting of a village grouped around some Chinese houses, with poplars and cultivated fields; Nan-cho, this too a Chinese village with cultivated land; Gen-deng, or a Chinese caravanserai, without grazing, situated on the left bank of the Tan-ho, a tributary of the Bulundsir-gol: thence it is a day's journey to Tung-chuan or Sa-tscheo.

July 6th. Leaving Basch-kurghan we crossed the big valley between the two parallel chains of the Astin-tagh, and struck south-south-west up beside the middle eroded watercourse. The glen rose gently and regularly. The watercourse was dry, but from the water-mark about one foot above its bottom, it was evident that it does sometimes carry a fair quantity of water. Here there is solid rock nowhere: it is all gravel-and-shingle, gravel, and coarse sand, the products of disintegration which have collected at the northern foot of the Tschokuluk-tagh, where it forms a flat detritus slope, deposited in layers of varying thickness. It is through this

material that our watercourse has carved its way, being inclosed between vertical walls some 10 m. high, and the height increased as we advanced towards the entrance of the glen of Basch-jol, until on both sides the solid rock gradually began to take the place of the softer material. So long as we were in the watercourse we were unable to see to either the right or the left, and it was only occasionally that we caught glimpses of the peaks of the southern range. As my map shows, the detritus slope is seamed on the surface by a countless number of dry ravines of all sizes, running down, some to our watercourse, some to the other two watercourses. In the very entrance to the glen we again came upon a small rivulet with good bright water, though it soon disappears in the gravel in the dry bed of the stream. It owes its origin to the spring of Basch-jol, which bubbles up out of the level ground on the left side of the glen and is surrounded by good grazing, in fact by a small fresh meadow. The temperature of the water that gushed out of the spring was  $5.8^{\circ}$ . Here again there are the remains of a fort, in a somewhat better state of preservation than that of Basch-kurghan.

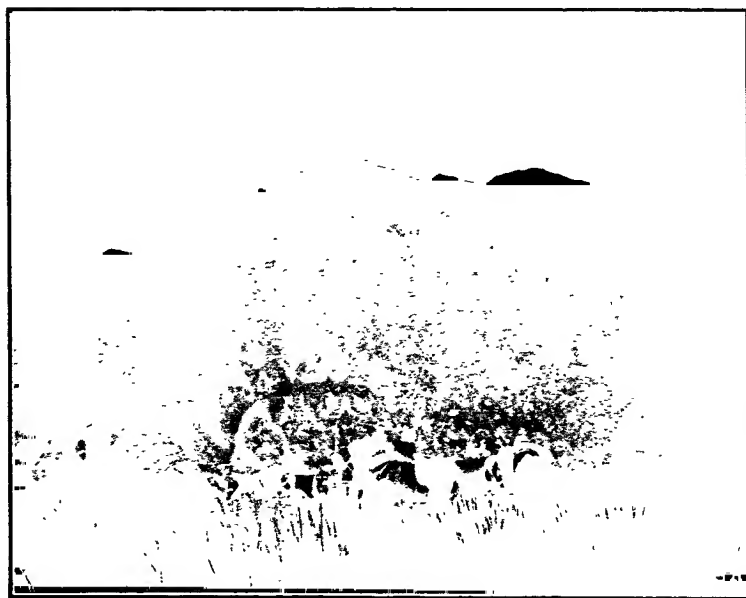


Fig. 17. BASCH-JOL.

The bluff north-east of Basch-kurghan consists of black schist with dykes and veins of red pegmatite; in fact these two species of rock occur in intimate association throughout the whole of the Kurghan-saj. At the point where the little brook of Basch-jol dies away, there is black schist dipping  $73^{\circ}$  S.; immediately below the spring the same rock lies  $85^{\circ}$  towards the S.  $15^{\circ}$  E.; at Basch-jol itself there is on the left side of the glen a schist, lighter in colour than the preceding, and dipping  $67^{\circ}$  to the N.  $35^{\circ}$  W., which crops out in the form of shelves and darker bands, the slopes between being covered with soft disintegrated material. The nearest mountains on the right side of the glen have soft, rounded outlines; but beyond and above them there rises an important crest, an offshoot of the true main range of the Tschokuluk-tagh, of which however only one or two peaks were visible.

Of course I was only able to note the nearer orographical features of the mountain-ranges; to have traced out their connections and the directions in which they run would have demanded several crossings. Such particulars as I did ascertain are represented in the accompanying little sketch (fig. 6), namely the different zones that intervene between the Kara-koschun and the foot of the mountains, as well as the east and west extensions of the lowest ranges. This orientation was indeed evident from the glen of Tatlik-bulak, which slopes down westwards between two east-west crests of the system of the Lower Astin-tagh. It is perfectly obvious that the orographical structure of the border-ranges of the Tibetan highlands must be more complicated than it is on the flat, level plateau farther south.

At Basch-jol, where we halted for a day's rest, we felt very distinctly the currents of air streaming up and down the glen. The descending nocturnal wind blew with a velocity of 4.6 m. in the second, the ascending diurnal wind with a velocity of 3.6 m. in the second. Basch-kurghan lies at an altitude of 2,629 m., or 676 m. higher than Tatlik-bulak, and Basch-jol at an altitude of 2,936 m.

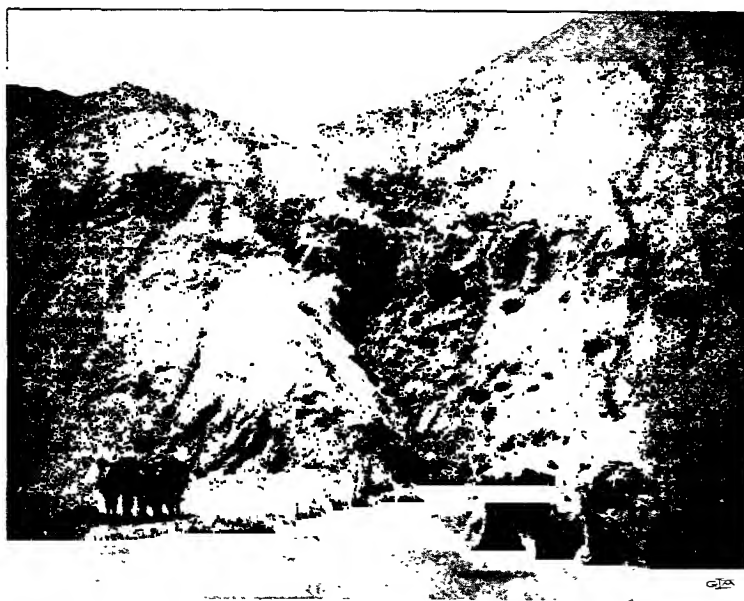


Fig. 18. THE SAME.

July 8th. The gently ascending, debris-strewn glen expands above Basch-jol and is joined by several side-glens, all coming from the northern slope of the main range of the Astin-tagh. From the east issues the Tschokuluk-saj, the upper part of which is said to run east and west; it is almost as big as the glen of Basch-jol. At the junction of the two there was some scanty vegetation around a small spring. A little higher up a glen comes down from the S.  $35^{\circ}$  W., with a track leading to Jan-bulak, a distance that is stated to be as great as that between Basch-kurghan and Basch-jol. After that our glen inclines to the south-east, and becomes fenced in on both sides by steep, dark, wild-looking cliffs. On the right side of the glen there forms after rain a pool, then dry, which bears the usual name of Tasch-köl. The glen is here far more energetically modelled than at Kurghan-saj; through the

gravel-and-shingle that fills the bottom the water has carved a deep and strongly accentuated bed, with steep and even vertical sides. The track runs sometimes on the one side, sometimes on the other, and sometimes in the bed of the stream. The latter is joined from both sides by similar deep drainage gullies, all at that time dry. The erosive energy has thus been developed here more strongly than in the northern glens of the Astin-tagh. But after our glen turns to the east-south-east the country becomes more open, the watercourse grows shallower and smaller, and we soon reached the summit of the range, namely a flat, very easy and comfortable pass without a name, but reaching an altitude of 3,588 m. On the top is a small cairn of stones crowning a hill. From that point there is a very extensive view towards the east, through a broad open latitudinal valley. A few kilometers away in the same valley there is another similar flat pass. All the rainwater channels between the two passes gather to a head and pour through the transverse glen that we subsequently followed; and similarly the water gathers off the mountains beyond the eastern pass into a second similar transverse glen, which likewise runs down to the great latitudinal valley on the southern side of the main range of the Astin-tagh.

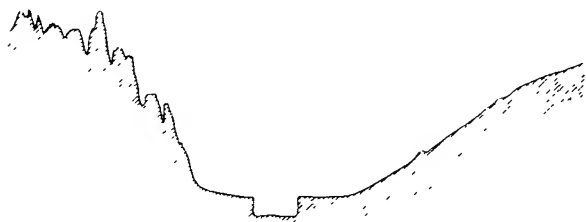


Fig. 19.

All the way from Basch-jol upwards the same varieties of rock prevail that we found at Basch-jol itself. At Tasch-köl the black schists embrace a large intrusive mass of quartzite, and higher up white veins and dykes frequently show themselves cleaving the schist. Immediately beyond Tasch-köl this latter rock assumes the position

69° to the S. 10° E.; just west of the pass it dips 76° towards the S. 20° E.; in the transverse glen that runs down to the south 64° towards the N. 50° W.; and near the exit of that glen 35° towards the S. 60° W. In consequence of the steep pitch of the strata the cliffs are extremely jagged, rugged, and pinnacled, and present many fantastic and picturesque outlines, such as crenelated bastions and so forth. This was especially true of the cliffs on our left as we marched eastwards up towards the pass, though those on the opposite or southern side were covered with loose disintegrated material.

I was amazed at seeing, a few kilometers east of the pass, two or three wild camels moving slowly towards the north; we had first detected their fresh tracks quite close to our pass. I had never before known these shy creatures to approach so close to a road that is used, at any rate sometimes, by human travellers. They were no doubt wild camels from the Kuruk-tagh and the Desert of Gobi, for these animals are sometimes driven by the heat of summer up into the cooler mountainous regions, where water and grazing exist. Later on we shall find that these eastern parts of the Astin-tagh are favourite grazing-grounds of the wild camel.

Shortly after we crossed over the pass the road we were following turned off sharply at right angles to the south, descending by the transverse glen that cuts its way through the little range of foothills at the southern base of the main range. This transverse glen, although quite short, is not particularly steep; the pass there-

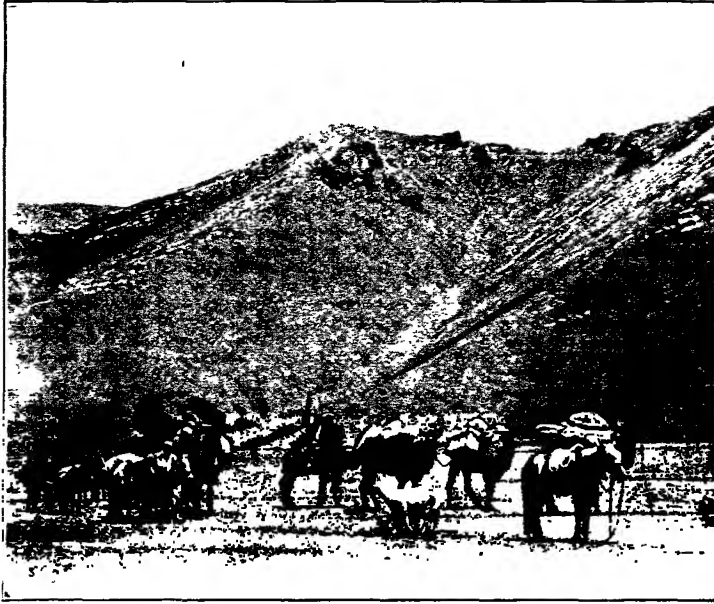


Fig. 20. THE UPPER ASTIN-TAGH.

fore lies a good deal outside the main axis of the system, for the principal mass of the Astin-tagh (i. e. the Tschokuluk-tagh) lies to the north of it, and only a small portion to the south. In this way we gradually climbed up to the highlands of the Tibetan plateau. Later on I propose to deal with the altitudes in connected sequence.

The little glen which we had been following issues into a broad latitudinal valley, stretching from east to west between the Astin-tagh and the Akato-tagh, the next parallel range on the south. This valley possesses no special name, but is called

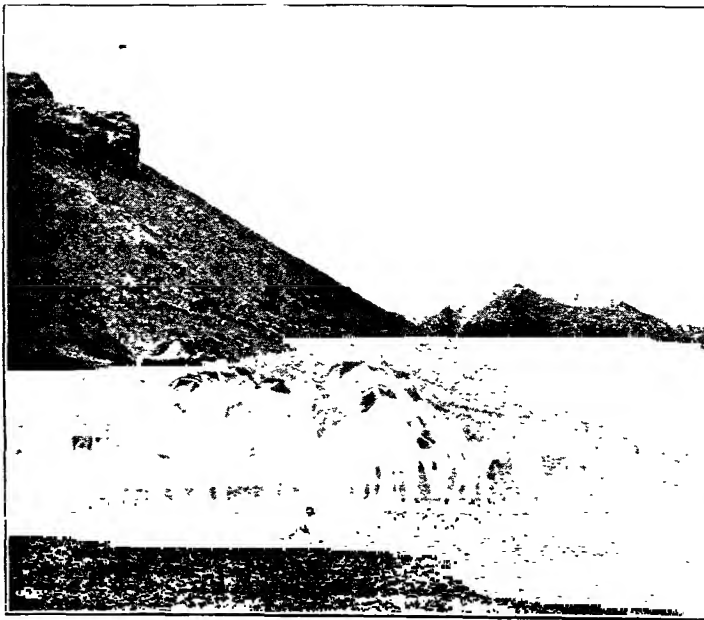


Fig. 21. THE UPPER ASTIN-TAGH.

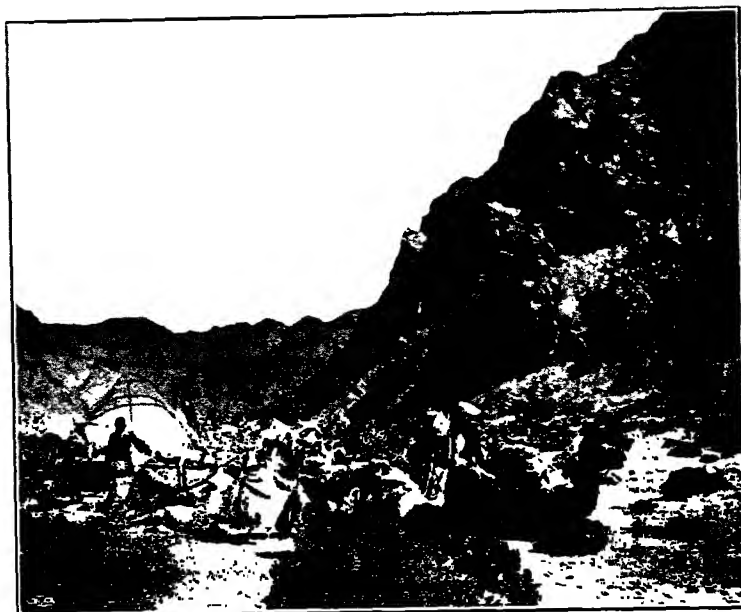


Fig. 22. THE SAME.

simply Kakir, a word which means »a hard, sterile, dry clay bottom . From the southern foot of the Astin-tagh the slope is very gentle,  $1^{\circ}$  to  $1^{\frac{1}{2}}^{\circ}$ , though perceptible to the eye. The surface consists of fine, powdery material, little gravel, and is seamed by dry watercourses running S.  $25^{\circ}$  E. down to the main stream, which keeps to the south side of the valley. At the point where we crossed it the main stream was flowing towards the east-north-east. It is also joined by dry ravines from the Akato-tagh, but they are both smaller and fewer in number. Immediately north of this watercourse the track we were following is connected with another track leading from Usun-schor in the west. In the south-west the dominating feature was

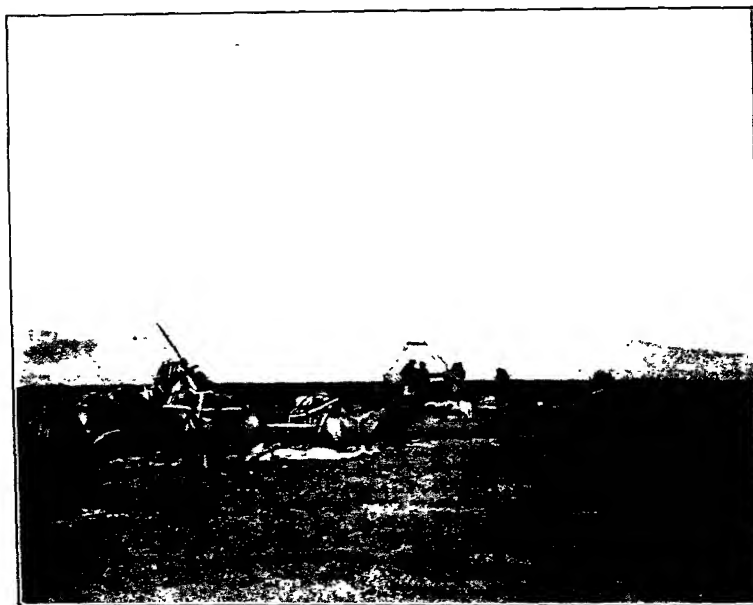


Fig. 23. CAMP V.



Fig. 24. THE SAME.

the snowy mass of the Ilve-tschimen, with which we shall make a closer acquaintance lower down. On the southern side of its main watercourse the bottom of the latitudinal valley slopes at an extraordinarily gentle angle up towards the northern foot of the Akato-tagh. The ground is absolutely sterile, not a trace of animal life to be seen. A little farther south the surface appeared to be perfectly horizontal; at all events there was not a single torrent to indicate that there was any slope. At Camp. No. V (alt., 3,081 m.) there was neither grazing nor water; on the other hand teresken bushes now made their appearance and yielded excellent fuel.



Fig. 25. THE SAME.



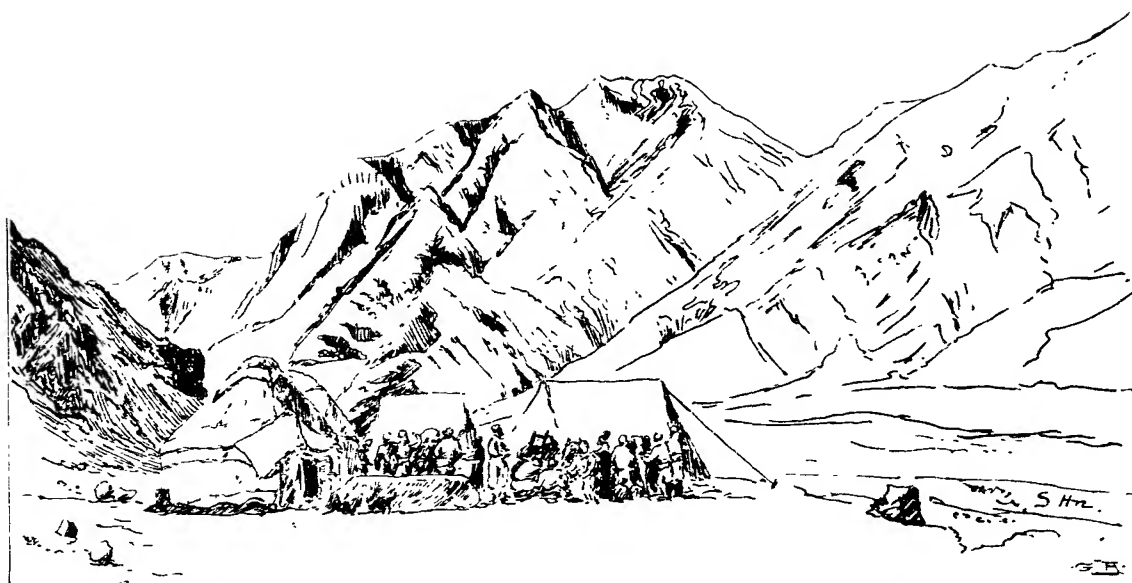


Fig. 26. MANDARLIK; IN THE BACKGROUND THE RIGHT SIDE OF THE VALLEY.

The unnamed pass in the Astin-tagh is thus the water-divide between the basin of Lop-nor, i. e. East Turkestan, and the broad Kakir valley, which appears to be divided into several very flat, shallow, self-contained basins, separated from one another by ridges or swellings of very slight relative elevation. Where we crossed it, the valley inclined unmistakably towards the east; but I was unable to ascertain how far its main artery extended or under what circumstances it comes to an end. The valley itself leads out, as we shall see subsequently, into the basin of Tsajdam. Whether the main stream of the Kakir valley reaches as far as that it is difficult to say. Westwards in the latitudinal valley there are some small self-contained basins, e. g. Usun-schor.



Fig. 27. THE ASTIN-TAGH AS SEEN TOWARDS THE NW.

Whilst we were still on the pass there fell a drizzling rain, but when we got down into the Kakir valley it rained at times pretty smartly, and even heavily, while the thunder rumbled in the Akato-tagh. All the same the rain did not fall in sufficient quantity to make the clay surface slippery. Generally however after rain the innumerable watercourses, which run as I have said towards the S. 25° E., carry down fine mud, which collects in the bottom of the main stream of the valley. Consequently this latter has a greyish-yellow colour, and is conspicuous a long way off as a lighter ribbon winding down the valley.

## CHAPTER II.

### OVER THE AKATO-TAGH AND THE TSCHIMEN-TAGH.

July 9th. For some hours further the track led almost due south. The snowy top of Ilve-tschimen shone out brilliantly in the clear atmosphere, but the long crest of the Astin-tagh was but faintly outlined, and now appeared, seen at such a great distance, to be twice as high as when we were close to it. That however was but an illusion, due to the long gentle slope on its southern versant. As seen in the morning sunlight, it was lit up with precisely the same shades as the range itself, the whole appearing like one unbroken upward sweep (fig. 28). On our left we had the range of the Akato-tagh, with its tolerably low offshoots, for we were approaching it at an acute angle, the range here running towards the east-north-east. Out of the transverse glens in its flanks issue the numerous gullies which we crossed, though they are frequently pretty deep and distinctly marked. The ascent was very slow in the direction in which we were travelling, though we could feel that it was gradually growing steeper. The surface was soft, there being but a thin sprinkling of gravel. The teresken steppe thinned out, the scrub being confined to the watercourses and gullies, in which water sometimes flows. To the west of our route I noted, at a distance of one to two kilometers, two quite small isolated rocky knolls rising above the level ground.

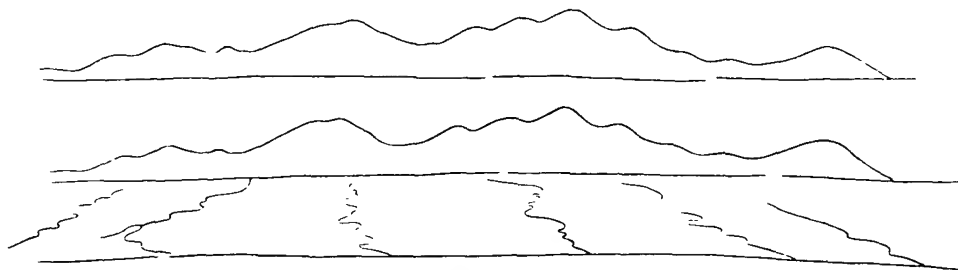


Fig. 28.

At the foot of a little spur of the Akato-tagh, built up of soft materials, there is a spring with a small open basin; its water, bright and beautiful, had a temperature of  $12^{\circ}$  C. This spring, which is known simply as Bulak, is surrounded by a small patch of luxuriant grass. A long way off in the S.  $80^{\circ}$  W. we could see a

light-coloured strip, the lake of Kala-köl, and in the S. 31 W., at the northern foot of the Akato-tagh and on the nearer side of the Ilve-tschimen, the white surface of the Usun-schor. With this intensely salt lake too we shall become better acquainted lower down.

Leaving the spring, we struck into a gorge, or dry ravine, cleft through the gravel-and-shingle, and running towards the south-west, and after emerging from it, turned to the south-south-east.



Fig. 20.

At 11 o'clock the sky suddenly clouded, and a sharp shower fell; but it was followed by a hard storm from the south-west, heavily charged with dust and sand. Its onset was peculiar, for it resembled a gigantic bolster, dark brown in colour owing to the dust that it had caught up, and it approached rolling bodily along across the steppe. During the two hours that the storm lasted, we saw nothing of our immediate surroundings, except the track actually under our feet. After the storm had ceased with the same suddenness with which it began, the air cleared all at once, and left none of the fine dust behind it, very different from the storms in the lowlands, after which the air is wont to be thick for a couple of days. It was as though we had ridden through the storm-path of some local mountain wind intimately related to the configuration of the locality.

The part of the Akato-tagh which we here had on the east of our route appeared to stretch towards the north-east or north-north-east, and was pierced by numerous glens. From one of these issues a large watercourse, which winds down S. 57° W. to the Usun-schor. Shortly after that we reached the foot of the Akato-tagh, with a gently sloping talus of débris, overgrown with teresken, in front of it; here a slight depression leads up to a small pass. Here too there are some small dunes of drift-sand, blown together by the south-west wind. After that we made our way up a gentle slope towards the south-east and east between inconsiderable ridges, the slope growing flatter and flatter as we ascended, until at length it was more like an ordinary saj; it was covered with sand and gravel, amid which grew a little scanty scrub. The ground was but slightly broken. This led us up to the pass (3208 m.) of the Akato-tagh. The mountain ridges on both sides of the pass appeared to run principally east and west, but are at the same time rather truncated and irregular. Immediately south-east of the pass another glen leads off in the direction of Usun-schor. It is through it that the usual road from Tscharklik to Tschimen runs; this road too we shall become acquainted with lower down. Very soon the two roads unite and form one, which leads towards the south-east between the southern ramifications of the Akato-tagh. These gradually diverged, and we at length came out upon another extensive latitudinal valley, running parallel with the Kakir valley.

Shortly afterwards the hard gravelly saj came to an end, and was succeeded by hard, level, yellow clay mud, which has been brought down and left there by the torrent that flows down the glen from the pass. On the right we had the continuation of the saj and on the left scanty, but very sappy, kamisch. In the middle of the level steppe is a little lake, barely 500 m. long, with good clear water, and surrounded by grazing. It is generally called quite simply the ›köl‹, though it is also known as the Tschimen-köl, a name which I also heard applied to the Ghas-nor farther east in the same latitudinal valley, and which I therefore all the more willingly reserve for this lake. The altitude here was 3004 m.



Fig. 30. OUR FIRST CAMP IN THE TSCHIMEN-VALLEY.

Reverting to the Akato-tagh, for we now had this range behind us — I may add, that at the first little pass the rock consisted of grey granite, tolerably weathered, arranged in terraces and dipping at  $47^{\circ}$  to the south; shortly afterwards, where it occurred in conjunction with black schists, the granite dipped  $46^{\circ}$  towards the S.  $10^{\circ}$  W. Granite also predominates in the vicinity of the principal pass. At the southern extremity of the glen, and on its right side, there was a dark green schist dipping  $76^{\circ}$  towards the N.  $35^{\circ}$  W. In point of shape there is a great difference between the Akato-tagh and the main crest of the Astin-tagh. Nor has the former range any deeply eroded watercourses indicative of heavy rainfall; those that do seam its flanks are shallow and slight. The disintegrated material lies pretty evenly distributed in the glens. In fact the impression left on the mind is that the Akato-tagh is a ruined mountain-range, which has been severely levelled down, and that nothing now remains projecting above the debris except denuded crests and peaks. On both sides the slopes are long and gentle, and at the point where we crossed the range the ›pitch‹ was decidedly flat. In the same place the range is very narrow; towards the east however it broadens out, though only for a short distance; for a little way east of Ghas-nor it dies away, and finally disappears in the basin of Tsajdam. Westwards

however it swells out to a great breadth, forming a lofty and stupendous mountain-range, upon which rests the great mass of Ilve-tschimen.

July 10th. We now travelled south-east across soft, level ground, seldom undulating and then but slightly, and with an imperceptible slope towards the east-north-east. South of our route the predominating formation was saj with fine gravel; to the north kamisch grows, and the soil is just as soft and powdery as beside the Tarim. The kamisch is however rather scanty, and generally grows in small clumps. In all that soft material there is not a single chip of hard rock. There are a couple of smaller pools to the north-north-east and east-south-east of the lake. The middle of the steppe shows a broad depression, Kasch-balghun, the bottom of which is covered with gravel, while the steppe rises up on both sides in terraces. Here is Sasik-jarning-baschi, or the upper part of Sasik-jar, a dry ravine-like gully, 1' 2 to 2 m. deep, and running N. 85° E. A few kilometers below our route springs gush out of the escarpments on both sides; below the gully they grow more numerous, and finally give rise to a brook, which makes its way to the Ghas-nor. The Tschong-jar (Tschong-jarning-baschi) possesses precisely the same characteristics as the gully just mentioned, but it is deeper and has an abundance of kamisch both in its bottom and at the sides; in the latter position too there is an abundant bush vegetation. The next gully or watercourse is called Kulagh-jar (Kulagh-jarning-baschi), with thick, vigorous reeds. After that we passed a small oblong pool, with clear though salt water, this also embowered amid luxuriant vegetation. At Temirlik (Camp VII; alt. 2961 m.) we had an opportunity to study the origin of these *jars* or 'erosion gullies'. The gully of Temirlik begins quite abruptly (fig. 31), for though it runs towards the north-east, there is no upper part coming down from the Tschimen-tagh. At its very start it is a deep hollow in the ground, from the side-terraces or *jars* of which springs gush out, their water speedily gathering into a little rippling brook, and this by its distant murmur showed that it soon swelled into a bigger torrent. The water at the springs had a temperature of 5.2°. Around them the grass was especially luxuriant. The brooks in the four gullies I have named gradually converge into one, and this is soon joined by several others, all coming from the south, and the whole eventually enters the Ghas-nor. These gullies thus carry water all the year round, right away from their very origin, the water issuing originally from the snow-fields of the Tschimen-tagh, though it is only here that it emerges into daylight. At Temirlik there are a couple of old Mongol dwellings, in which we found some small *tsakhas*, or cones of clay, which serve some sort of religious purpose. The district is sometimes visited for its good grazing by the Tsajdam Mongols, though they avoid as far as possible coming into contact with the Muhamedans.

In respect of climate these highlands showed a great difference in the course of only two days' journey. We found the Akato-tagh excessively dry and flat, there being only one spring, at its northern foot. The next parallel range on the south rises up a lofty and imposing mass, and its summits, sometimes rounded, sometimes pyramidal, were everywhere capped with snow, though this, as I subsequently learnt, melts away entirely during the summer. Thus the Tschimen-tagh arrests and condenses all the moisture which is brought thus far by the southerly winds, all the moisture, that is, that succeeds in getting over the yet higher range of the Arka-

tagh; and but little, if any of it, reaches as far as the Akato-tagh and the Astin-tagh. But the Ilve-tschimen alone is crowned with perpetual snow. The Tschimen-tagh is pierced by several transverse glens, all opening upon the Tschimen valley. The one to the south-west of Temirlik is called Kisil-tschap; the others are, on the east, Soghok-saj, Tschigelik-saj, Gändschuluk, Alim Baj-saj, Korumluk, and Mandarlik. Hunters' paths lead up through several of these glens to the passes at the top. Down each glen courses a brook, originating in the snows, but they all alike disappear under the detritus at the northern foot of the mountains, though they make their reappearance, as we have seen, as springs in the lowest part of the Tschimen valley, for the greater part of its floor is covered by this debris-spread. The same difference that we observed between the Akato-tagh and the Tschimen-tagh with respect to water-supply obtains also between

the Kakir valley and the Tschimen valley. The former is absolutely dry and possesses no springs; while in the latter there are at least a couple of small lakes, and farther east the Ghas-nor, with, in addition, perpetual springs. Thus the Tschimen valley forms in



Fig. 31.

this respect also a transition between the dry latitudinal valleys that intervene between the extreme northerly border-ranges of the Tibetan highlands and the latitudinal valleys situated farther south, in which, as for instance in that which I mapped in 1896, there exist entire strings of lakes, big and little. Even at Temirlik we had a sort of taste of the characteristic Tibetan weather, so violent in its sudden and surprising changes. On 11th July, after a still, bright day, a storm burst about 10 o'clock at night. The wind came from the south, but at the same time black, compact masses of cloud went sailing away to the south-south-east; then all of a sudden the wind veered round to the west and began to blow hard, being accompanied by a violent and heavy rain. The thunder and lightning in the Akato-tagh were simply magnificent. In summer the Tschimen valley swarms with midges; about sunset they hover in perfect clouds around the springs. Nor is it until the beginning of September that they disappear.

July 12th. Continuing our journey towards the south-east, we crossed first the Usun-jar, a gully 100 m. broad and resembling those I have described above; lower down it possesses springs and a rivulet, which makes its way down to the principal brook in the valley. Then, after travelling for a considerable distance across the kamisch steppe, dotted over with *balghun* bushes with hard stems and roots, and frequently growing on miniature mounds, we crossed over the ravine of Basch-balghun, which is also fed by springs below the track. About an hour after that the steppe comes to an end, and is succeeded, quite abruptly and without any intermediate formation, by the hard level saj, which is seldom undulating and quite barren. We then turned to the east-north-east, and kept along the edge of the steppe, which appeared to stretch one green expanse all the way to the talus at the foot of the Akato-tagh, and is traversed by all the ravines as well as by the principal brook. Both *kulans*, or »wild asses», and hares were numerous on the steppe. In the south rises the peak V, the culminating point of a bluff of the Tschimen-tagh,

and it projects rather more to the north. Immediately over against this peak the Akato-tagh likewise appears to bulge towards the south, so that in that place the Tschimen valley is narrower than usual. On each side of the peak V are the glen of Gändschuluk, running towards the north-east, and the glen of Alim Baj on the east. Somewhat to the north of our route was a tract with springs known as Boghan-utschu, probably a ravine of the usual character. East of that point the principal stream of the valley is joined by no more contributory feeders.

After that the surface grew more undulating, and at times we appeared to be travelling between low escarpments, with vegetation between them, but barren on the top. Then came another ravine similar to the preceding, with vegetation in its bottom, known as Kumutluk, and in it just below the track was a spring, the water of which had a temperature of  $8.5^{\circ}$ , though it was not quite fresh. This brook does not however join the foregoing, but pursues its own way to the Ghas-nor, curving round to the north and north-east. Immediately east of that we crossed over two small ravines, which are said to originate in a valley between Gändschuluk and Alim Baj. Then turning towards the east-south-east, we saw the broad expanse of the lake of Ghas-nor occupying a considerable part of the breadth of the valley, but lying nearer to the Akato-tagh than to the Tschimen-tagh. In the west the lake is broad and blunted, but towards the east it gradually contracts, until finally it tapers away altogether. Beyond, in the line of its continuation, and on the other side of a stretch of schor, there is another small lake-basin. On the whole the lake is very shallow; in especial its western parts convey the impression of being but a marsh. It is said to be almost everywhere difficult of access, owing to its shores consisting of saliferous mud and ooze, which will not bear a man's weight. The only place in which it can be approached is a short stretch on the south-west, where its shore is scarped. Along the southern shore is a belt of grass, reeds, and balghun bushes; thence the lake narrows still farther in the same direction, sending apophyses or »fingers» into the hollows between the spurs of the saj escarpment that projects towards the north. This escarpment constitutes the extreme outside edge of the detritus slope lining the foot of the Tschimen-tagh. Thus the two sets of spurs »interlock» like the fingers of the clasped hand. In the hollows there is vegetation; on the convex upper surfaces gravel and sand, or fine, yellow dust; sometimes also there occur larger and smaller blocks of coarse-grained grey granite, as well as of black schist and gneiss. Immediately west of the Ghas-nor there is said to be a smaller lake, Ajik-köl, into which flows the Basch-balghun, the Ajiklik and Sägis-jar. Its water is fresh, and the lake discharges by a single emissary into the Ghas-nor. It is said to be fringed round by thick reeds and bushes. The name, which means Bear Lake, is given to it because the bears are attracted by berries which grow on certain bushes there. What relations, if any, exist between these three streams and those which I have previously mentioned from Kasch-balghun onwards, I was unable to unravel. The former appear to enter the Ghas-nor without touching the Ajik-köl. In a certain part of its course the main stream is called the Lajdang, a name that points to the presence of mud deposits. Wild-duck were numerous; they winter in the spring-fed brooks I have mentioned above, more particularly in the brook of Temirlik, as I saw from my own observation subsequently. I shall



Arka Tagh, Afghanistan

THE ARKA-TAGH. VIEW LOOKING NORTH FROM CAMP XXIII

Aug 7th, in the foreground Sand-dunes





return to the Ghas-nor, or Tschimen-köli, or Ghas-köl in a later chapter, for on another excursion I touched its north-eastern shore. The lake is of course heavily impregnated with salt, especially its eastern part. In many places its shores are quite white, a circumstance that seems to point to fluctuations in its level.

During this day's march we nowhere observed hard rock. Our route ran pretty near the middle of the broad valley, but gradually approached the Tschimen-tagh. North of the lake the Akato-tagh presents the shape of a gigantic loaf, being a rounded elevation, scored by innumerable eroded glens, gullies, and ravines. Nobody knew of any pass over the range at that part, though on a later occasion I was fortunate enough to find one.

The district in which we approached nearest to the southern shore of the lake is called Bel. A spring there, situated immediately to the left of the track, is known as Boghan-ottok; the tract between it and the next spring, Kalmak-kajnasi, produces an abundance of *boghana* bushes growing on heaps of loose soil. Camp No. VIII was made at Tschigelik, a well situated at the foot of a couple of sandy ridges in a clump of quite luxuriant vegetation. Its water, which was 1.20 m. from the surface and itself 12 cm. deep, was nevertheless exposed to the sun. It was tolerably good and had a temperature of 10°.<sub>0</sub> C.

July 13th. The sandy ridges, which are in part barren, in part slightly overgrown with vegetation, forced us to keep for a short distance to the south-east, after which we turned due south. The road to Tsajdam continues to the east-south-east and after three days is said to reach a district which the Lopliks call Eski-tschimen, or the Bad Pasture-Grounds. Here the vegetation comes to an end except for a little *tschutschun* scrub, and at the same time the rise in the gentle level slope began to be perceptible. The surface consisted partly of fine powdery dust, partly of gravel, partly of sand, this last often in the form of rudimentary dunes. In some places *teresken* grows on the edge of the temporary rainwater channels. At the point where we first approached the watercourse of the glen of Mandarlik the bottom was rather moist. Afterwards at the spot where we crossed it, it was distinctly trenched, and contained a brook with clear, fresh water. The gravel-and-shingle terraces through which it cuts its path are 8 m. high and the bed is full of gravel. The watercourse makes its way towards the eastern end of the Ghas Lake, but does not reach it, except possibly after heavy rain. At last we rode entirely between the eroded terraces, our direction being south-west and south, and soon we came to the broad and beautiful glen of Mandarlik. Near its issue this glen is joined from the right by a not inconsiderable side-glen. Alongside the brook vegetation is tolerably abundant and sometimes actually forms thickets. The name is derived from a species of climbing-plant, *mandar*, which runs over the *balghun* bushes. The Mongols call the place Balgunto. Other names that occur in the country to the south-east (which I did not visit) are Dschurcha, inhabited by Mongols, — the Mussulmans call the place Dschurek-tasch — Par, Kurmuto, Danganlunba, Dalung, Lofsa, Schara-gol (Turkish name Puj or Pschuj), Musluk, Kara-balik, Intschkä-saj, and Dung-saj. But from the descriptions given me it was impossible to form any idea of the relief. All that was clear was that most of the points named indicate glens between the secondary spurs of the mountains. Even the Tschimen-tagh itself has here an east-

west direction, while the transverse glen of Mandarlik runs south-north. I was told that east of this there are the transverse glens of Samsak-ajding, Kasch-otak, Kalpak, and Dobsa, all opening upon the Tschimen valley. On the other hand, it is not credible, that they all belong to the basin of the Ghas-nor, which on the east is fenced in by a low ridge.



Fig. 32. SUMMITS W AND V OF THE TSCHIMEN-TAGH AS SEEN FROM A POINT BETWEEN BASCH-BALGHUN AND BOGHAN-UTSCHU.

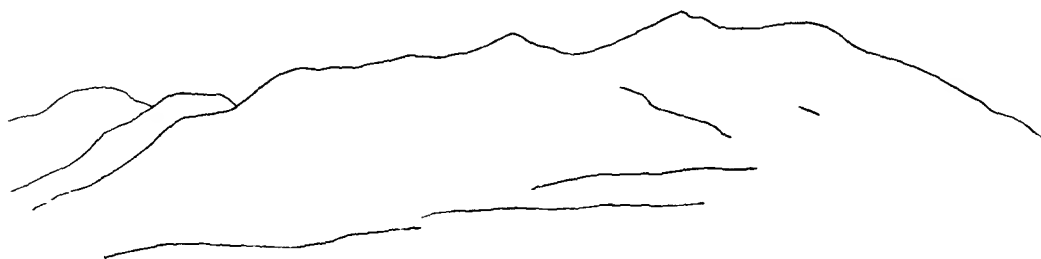


Fig. 33. MOUNTAIN WEST OF THE MANDARLIK VALLEY.

In the throat of the glen of Mandarlik there is on the right side black schist dipping  $47^{\circ}$  towards the S.  $45^{\circ}$  W., and on the west side a rose-coloured granite, very hard, and forming a vast dome-like mass, washed at its foot by the stream. Both species of rock occur rather abundantly in the form of fragments and gravel a pretty long way down the glen. Just below Camp IX was a fine-grained grey granite, interpenetrated by dykes and veins of a rose-coloured granite. Here grey granite dips towards the  $78^{\circ}$  S.  $70^{\circ}$  E. and predominates on both sides of the glen. Where the schists predominate the mountains are more jagged and fantastic; where the granite predominates more rounded and knobby. The bottom of the watercourse is filled with blocks of granite, big and little. The strongly developed terraces which overhang it are sometimes double, and above the upper step we observed traces of a third, though it is now for the most part worn away and defective. For a short distance on the left side all these steps merge into one single vertical wall. At the place where we encamped the glen was narrow, being contracted between the granite walls. The rocks there consist of several different varieties, amongst others being a fine-grained, striped variety of an almost black colour, resembling gneiss, and this is interpenetrated by veins and dykes of granite, of all sizes from 1 cm. to several meters in thickness, the granite being the same coarse-grained, reddish variety which alone seems to prevail higher up the glen.

Just above our camp the glen of Mandarlik was joined by a side-glen from the left, leading up to a little *bel* or rounded pass, from which another glen runs down to the north-west to join a larger transverse glen situated between Man-

darlik and Korumlik. This too seems to be of secondary rank, that is to say its *baschi* or upper part does not issue from the main crest of the Tschimen-tagh, but from one of its subsidiary crests. The little pass lies amongst coarse-grained, reddish granite. Above the throat of this side-glen the glen of Mandarlik widens out at the junction of the two glens which unite to form itself. With the more easterly of these two component glens we shall presently make a closer acquaintance. The other, on the west, also comes down from the main crest of the Tschimen-tagh, and is in its turn formed out of several smaller converging glens. At its head, in the south-west, rises the main crest of the Tschimen-tagh, its upper altitudes mantled with snow-fields, though they neither are sufficiently developed nor yet possess a sufficiently extensive gathering-reservoir to be able to give rise even to rudimentary glaciers. Below the snow-fields the bare rocky slopes stand out intensely black, as do also the portions that protrude through the snow. Below the rocks are spread the dome-shaped rounded heights and slopes, green with *jajlaks* or »pastures:. One more terrace-like continuation carries the mountain-flanks down to the expansion at the convergence of the two component glens already mentioned. There the grass is full of sap and is dotted with several small marshes. The watercourse itself is choked with blocks of granite and with gravel. Higher up in this glen wild yaks were pretty numerous. On one occasion we saw a herd of over fifty head, consisting almost entirely of cows and calves. Partridges also were abundant. Had it not been for the swarms of midges, the place would have made first-rate summer quarters. But beyond this spot we were not followed by our small, but persistent, tormentors.



Fig. 34. THE MOUTH OF MANDARLIK.

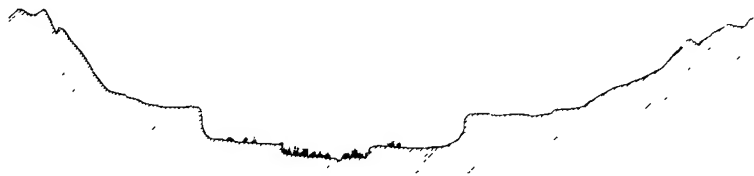


Fig 35. THE EROSION BED OF MANDARLIK AT THE CAMP.

As on the evening of 14th July a smart rain fell, simultaneously with a plentiful snow-fall in the higher regions, the brook of Mandarlik swelled very considerably, and the greyish muddy torrent coursed with a hollow roar amongst the water-worn granite blocks in its bed. But by the afternoon of the 15th the stream had resumed its normal dimensions and the water was again clear. Its breadth was as much as 5.5 m., its depth 27 cm. at the most, its velocity 64 cm. in the second, and its volume 0.764 cub.m. in the second.

July 20th. Camp No. IX in the glen of Mandarlik was the starting-point for our first big excursion of that year into eastern Tibet. I took with me only a part of the men and animals (camels and horses); the rest were left at Mandarlik, with instructions to move after a time to the lower part of the *jar* of the Temirlik, which I had selected to be our headquarters, base of operations, and rendezvous. During my absence regular meteorological observations were taken first at Mandarlik and afterwards at Temirlik, and at the same time the self-registering instruments were never stopped.



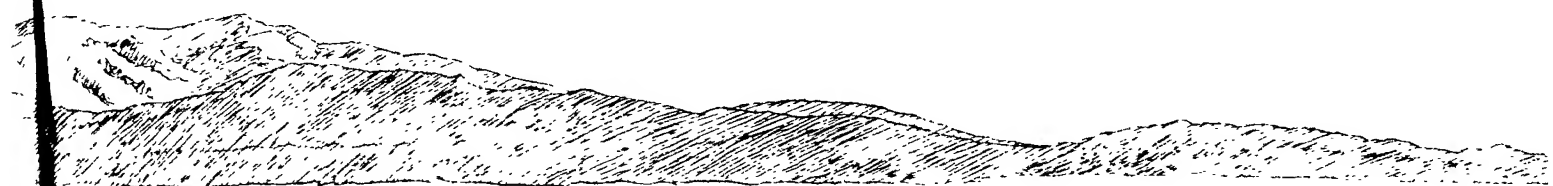
Fig. 36. A MOUNTAIN MASSIV JUST ABOVE MANDARLIK.

Of the two component glens which unite to form the glen of Mandarlik the western glen is the larger, and it is from it that the water flows. From it too a path is said to lead over the Tschimen-tagh, although the pass at the top is said to be difficult; at any rate it is only used by hunters. I chose therefore the eastern branch, which was then quite dry. It is shut in by hills of soft earth and moderate elevation, and possesses some vegetation. But these hills are backed by much higher cliffs, of wild and majestic aspect, and more or less serrated crest. Some distance up we came to the meeting-place of the three head-glens that form this eastern arm. We chose the middle one. It is tolerably short, is inclosed between soft hills, and leads up to a small secondary pass. But the most important of these three head-glens is the one that comes from the east: it is broad and open, and affords a splendid view of the wild and lofty summit of the subsidiary range which strikes off northwards from the Tschimen-tagh and extends as far as our camp at Mandarlik. The third or western of these three head-glens appears to originate in the main range of the Tschimen-tagh, beginning immediately underneath its snow-fields. The descent from the little pass on the southern side is very easy; from it stretch towards the south-east rather extensive grazing-grounds over a soft, undulating surface. Immediately to the south-west of it rises a vast bluff of black rock, jutting out like

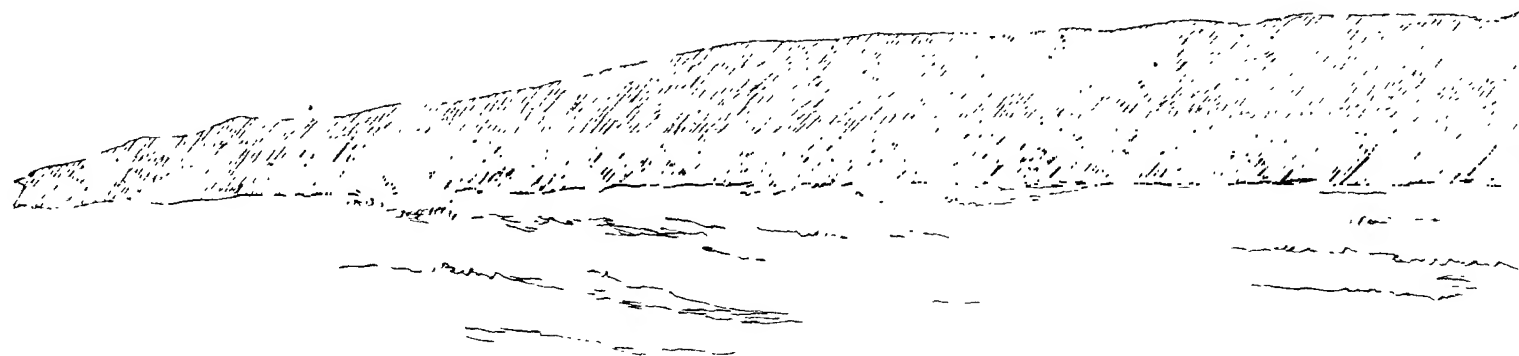




The Tschmen tagh



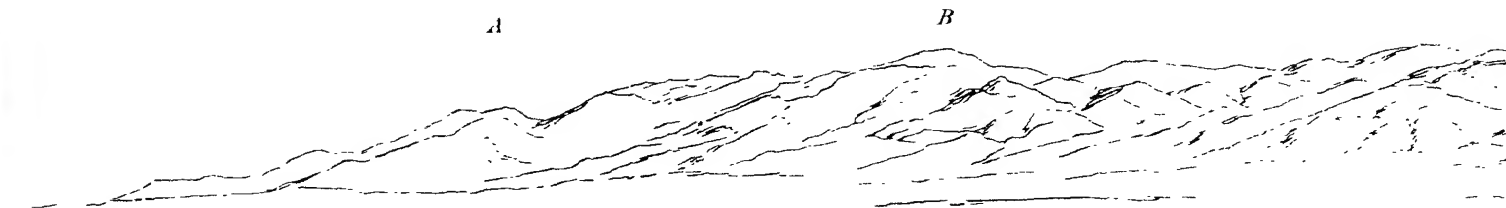
Temp VII Tschmen tagh July 11



Akato-tagh



Temp VII July 12



Temp VII Akato tagh July 13



Temp VII July 14 35°



Temp VII July 15



S. H.





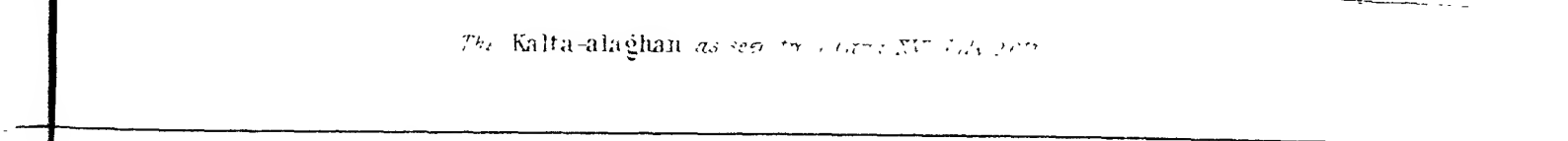
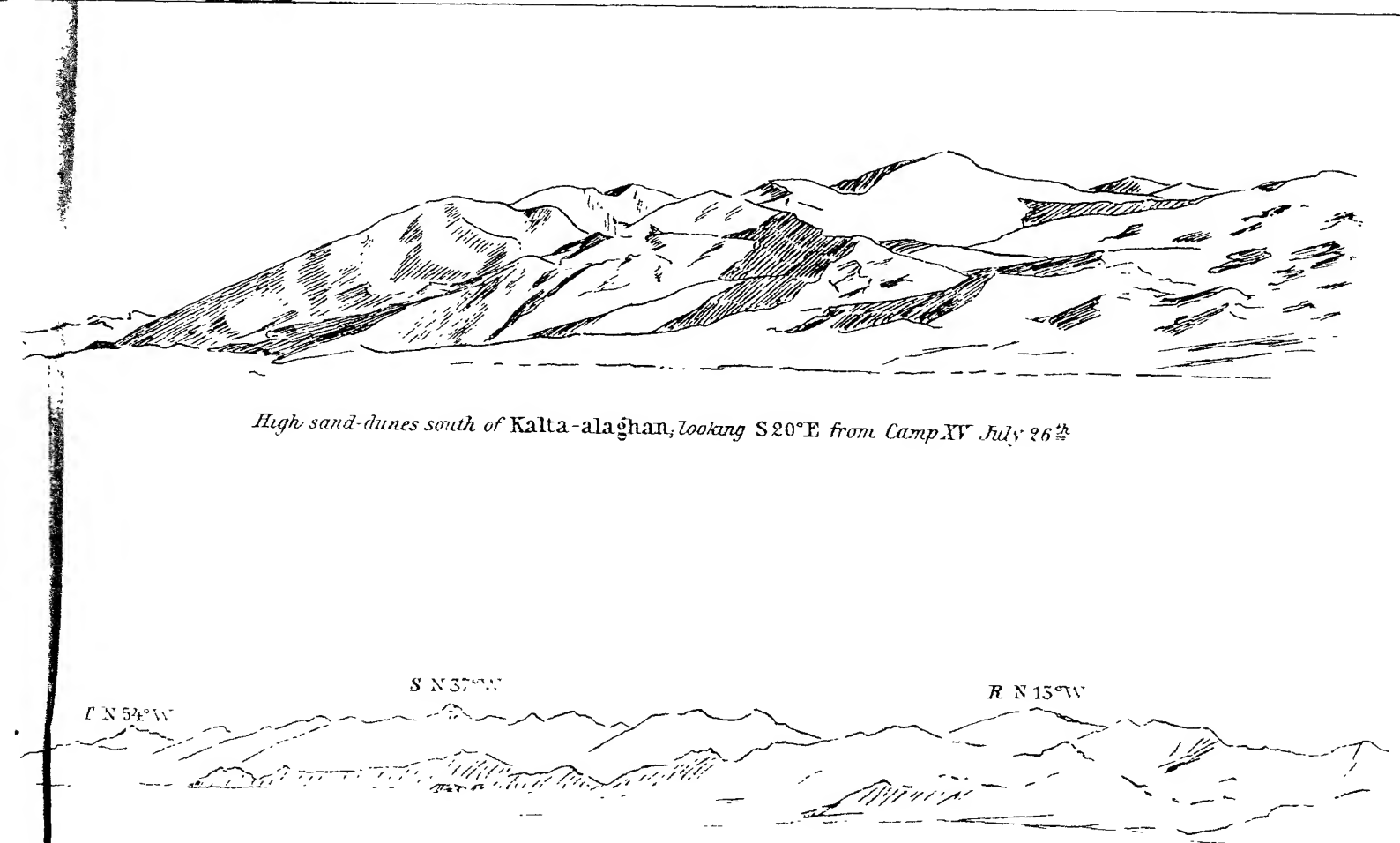
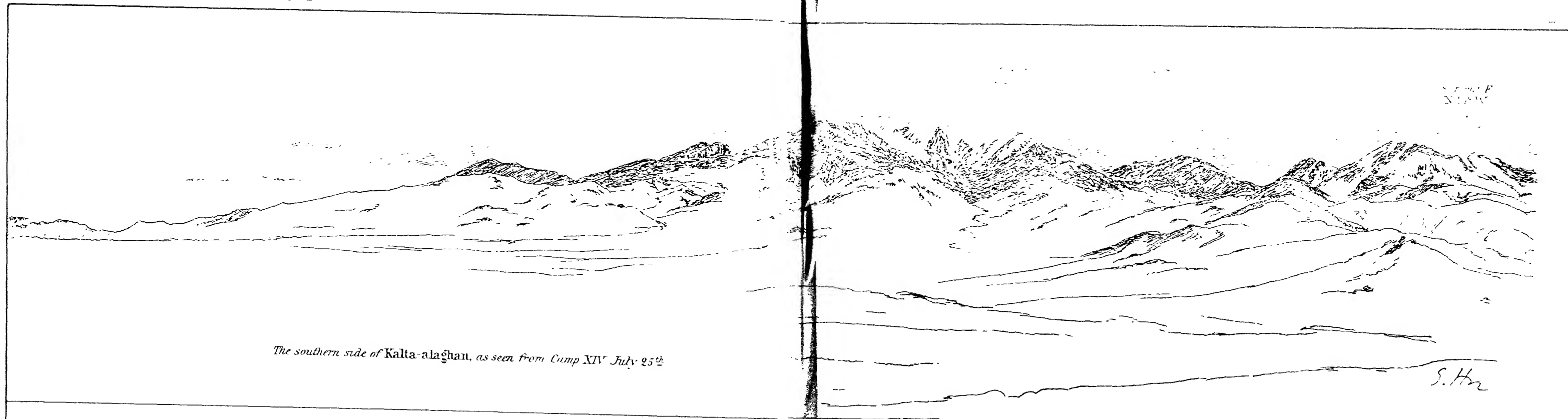






Fig. 37. MANDARLIK.

a promontory. The watercourses which seam the pastures run towards the west-north-west, and serve as feeders to one of the head-glens of the glen of Mandarlik. Proceeding up this glen to the water-divide at its head, an insignificant, easy, rounded swelling, we went down on the other side by the glen of Dung-saj, which constantly carries water, proceeding from springs in its upper part — a deep and energetically trenched ravine which we had directly on our right hand. Another watercourse immediately south-east of this ravine likewise contained water. The ground, which consists entirely of soft materials, is furrowed by hundreds of shallow watercourses, big and little, and the track consequently runs up and down and zigzags in and out. One of these watercourses, the principal watercourse of the region, extends a long way to the east, and finally joins the Kar-jakkak. Traversing this furrowed district, we gradually made our way higher and higher, and so crossed over the last little pass that separated us from Kar-jakkak. The descent on the other side is very steep. The brook of Kar-jakkak was about the same size as that of Mandarlik; it rippled along amongst the water-worn granite blocks, and its margins were fringed with moss and other fresh green plants. On the left, that is the west, we passed a large side-glen, from which the main glen derives a good deal of its water. Camp No. X was pitched in the glen of Kar-jakkak. Here the droppings of kulans and wild yaks were abundant, and two or three skulls of the last-named indicated that the region is visited by hunters, who make their night-quarters in a cave in the bank

of the stream. We also noticed marmots, partridges, and eagles. Nature was beginning to assume an Alpine aspect; the atmosphere was pure, fresh, and bright.

All day our march lay through a granite region, the rock being of various varieties, and perpetually alternating with a fine, crystalline rock, black and extremely hard, like diabase, which every now and again turned not only a lighter colour, but also coarser of grain. The granite is generally light red or grey, and coarse-grained. All the gravel-and-shingle in the glens is composed of these two rocks. The black



Fig. 38. THE LEFT SIDE OF THE VALLEY AT MANDARLIK.

projecting bluff south of the two small passes is built up of the dark, fine-grained rock, which dips chiefly  $54^{\circ}$  towards the N.  $60^{\circ}$  E., though sometimes also in other directions. In some places it forms gigantic slabs, piled concentrically one upon another. All the slopes between Dung-saj and the last pass are clothed with fine, yellow, soft, grass-grown earth. At the last pass we found green granite, dipping  $76^{\circ}$  towards the N.  $55^{\circ}$  E. At Kar-jakkak-saj the dark, finely crystalline rock is exposed on both sides of the glen, more especially on the left side; at first it dips  $85^{\circ}$  towards the S.  $10^{\circ}$  W., and at our camp  $54^{\circ}$  towards the N.  $30^{\circ}$  E.

The black cliffs, sharp-cut and bare, usually form a striking contrast to the soft, rounded heights below them; below these again comes an underlay of gravel-and-shingle and disintegration products. These crop out in the bottom of the water-course, though there also, as well as in its sides, the hard rock comes to the surface. The annexed profile (fig. 41) shows hard rock covered by a layer of soft earth.



*Ljustr, A. B. Lagredus & Westphal.*

OUR CAMP AT MANDARLIK.



The most important topographical feature of the day's march was that we crossed over from the glen of Mandarlik to the glen of Kar-jakkak. Both glens proceed northwards from the main range of the Tschimen-tagh and possess the same geographical value. The pass we crossed by is situated in the crest which separates the two glens from one another; in fact this is the only place in which this particular crest can be crossed, for lower down, where it consists of rugged cliffs, it is impassable.

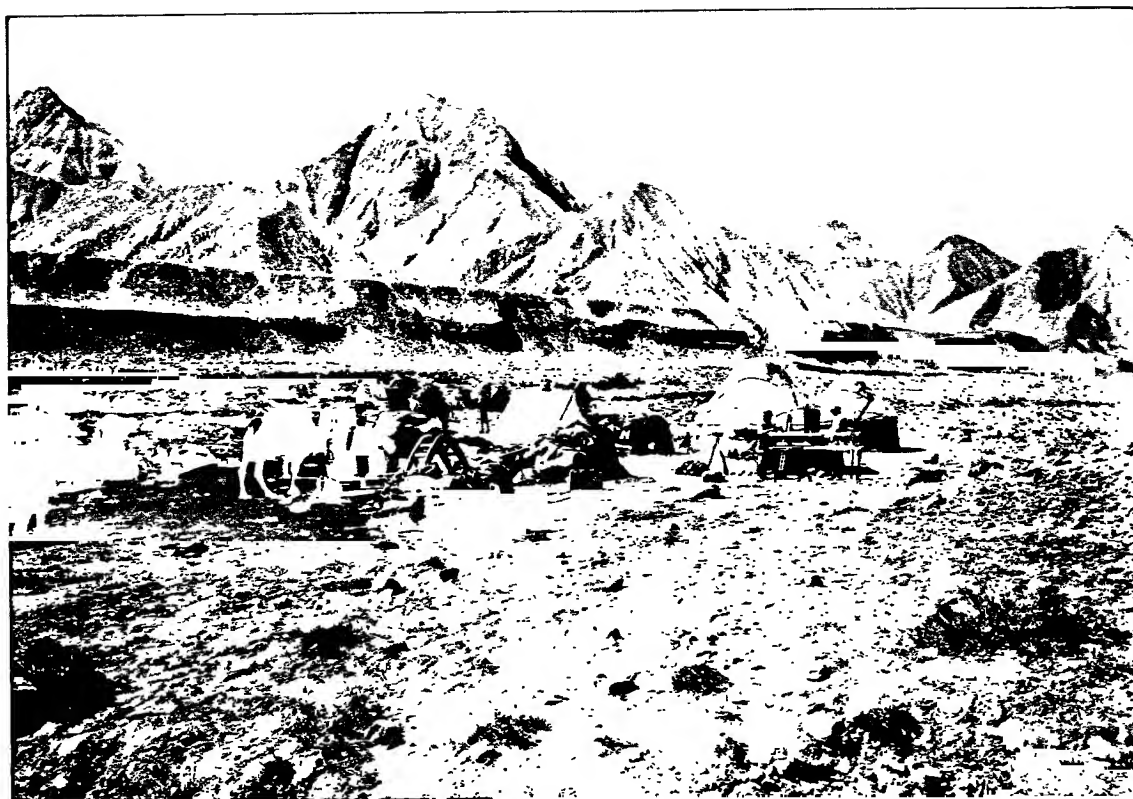


Fig. 39. THE RIGHT SIDE OF THE VALLEY OF MANDARLIK ABOVE THE CAMP. THE RIGHT EROSION TERRACE IS DISTINCTLY VISIBLE. TO THE RIGHT OF THE PHOTOGRAPH IS THE METEOROLOGICAL OBSERVATORY.

With respect to the climate a great change had taken place. For a short time that evening the wind blew with great violence from the north-east, and though we had but a drizzle around the camp, we saw how heavily it was raining lower down the valley. During the night it snowed pretty smartly, and next morning the entire landscape was covered with a thin but unbroken sheet of snow. But by 8 a.m. big patches of bare ground were showing through it, and two hours later most of the snow had disappeared; though through the haze and the heavy rain-clouds we perceived above the camp the white gleam of the mountain-slopes to the south-west. Owing to the rain and the snow the soft soil had become very slippery and greasy, in fact it was no better than a mud-puddle. During the course of the day the brook swelled greatly, so that by the evening it was a roaring, foaming torrent of a brownish-grey colour. The temperature of the water amounted to  $2.1^{\circ}$  at 9 p.m. Thus the name of the place, Kar-jakkak (= Where the Snow Falls), proved

itself, at any rate on that occasion, peculiarly appropriate. The clouds appeared to come from the west-south-west, but down in the valley the wind blew sometimes from the north-east.

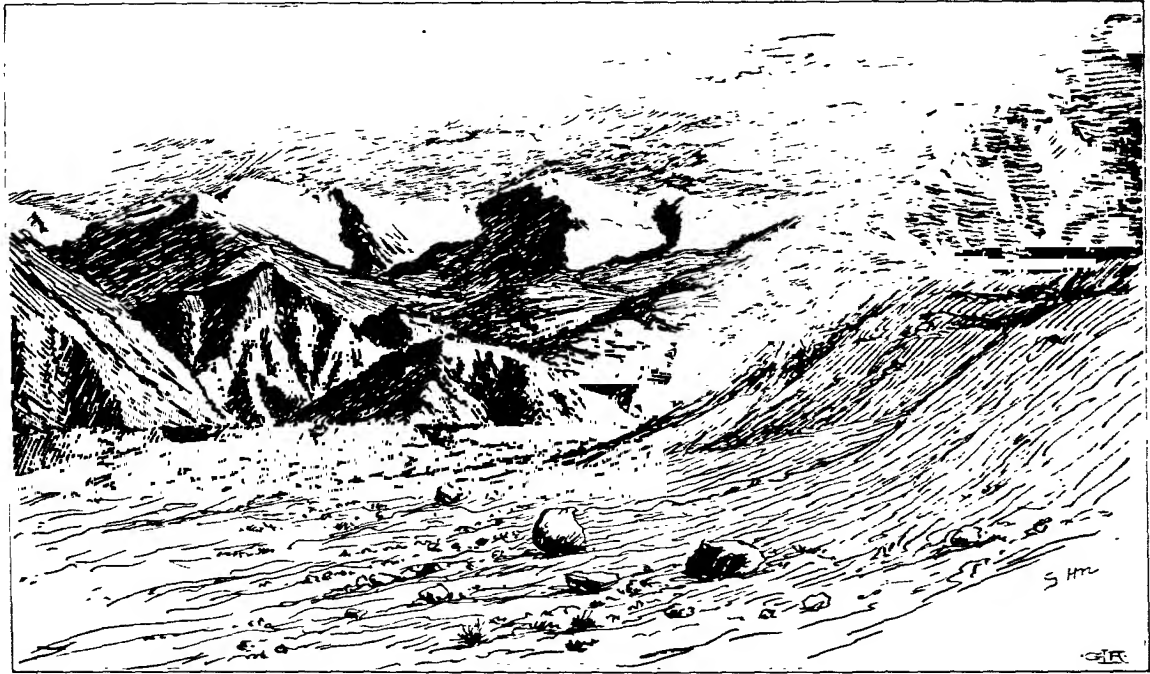


Fig. 40. THE MAIN CREST OF TSCHIMEN-TAGH IN THE UPPER PART OF MANDARLIK.

Although situated in the heart of the continent, the Tschimen-tagh shares in many respects in the characteristics of the peripheral mountain-ranges. Whereas the Astin-tagh and the Akato-tagh are dry, crumbling ruins, the Tschimen-tagh is still, so to speak, a living range, with precipitation, perpetual snows, perennial springs and brooks, pasture-grounds, and animal life. In the arid mountain-ranges the only animals met with are wild-camels and an occasional antelope or wild-sheep; but in the Tschimen-tagh we observed, in addition to antelopes and wild-sheep, also kulans and wild-yaks, hares, foxes, wolves, marmots, partridges and several other creatures. While in the former ranges the springs are situated 12 to 14 hours apart, in the Tschimen-tagh water can be found almost everywhere.

Since leaving the Ghas-köl we had ascended fully 1000 m. Camp No. VIII, at the south end of that lake, had an altitude of 2977 m. Mandarlik lay at 3437 m., and Kar-jakkak at 3984 m. It was here we began to be conscious of the mighty swelling of the Tibetan plateau.

July 22nd. It snowed all day long. In the hollows and glens the snow fell in the form of big buoyant flakes, which vanished the moment they touched the ground, for the earth was warmed several degrees above zero, and in this way became increasingly wetter and more slippery. But up on the heights the snow was granular, and the small, light grains rolled a little distance along the ground before melting. It was only in the higher regions that the snow remained. The snow-clouds came from the south-west.



At first we travelled south-east, crossing the little range that separates Kar-jakkak from Kitschik-kara-balik. Lower down this glen unites with the Tschong-kara-balik, the two being separated by a spur from the main range of the Tschimen-tagh. The name Tschong-kara-balik, although meaning the Big Black Fish, is not in any way intended to point to the existence of fish, only to the débris of the black schist which litters its bottom. At the point where we crossed over it, this glen consists of two smaller convergent glens, each traversed by a brook that issues from the main range of the Tschimen-tagh, which we now had pretty close on the south-west. The united Tschong-kara-balik appears to be of a considerable size and runs towards the north-east. The Kar-jakkak is probably identical with the Samsak-ajding and the Kara-balik with the Kasch-otak, the latter names being doubtless restricted to the lower ends of the glens.

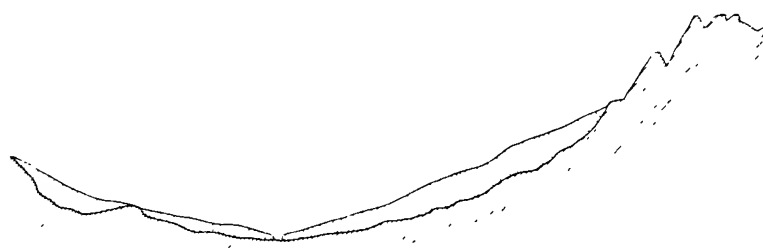


Fig. 41.

The two brooks I have mentioned, together with several others which we passed later, have cut their beds 3 to 4 m. deep, and have steeply eroded banks. It is only in the bottoms and sides of these watercourses that we find the bare granite and coarse gravel, all the slopes thereabouts consisting otherwise of soft material. The next brook of the same character is the Kuruk-saj, which, to judge from its

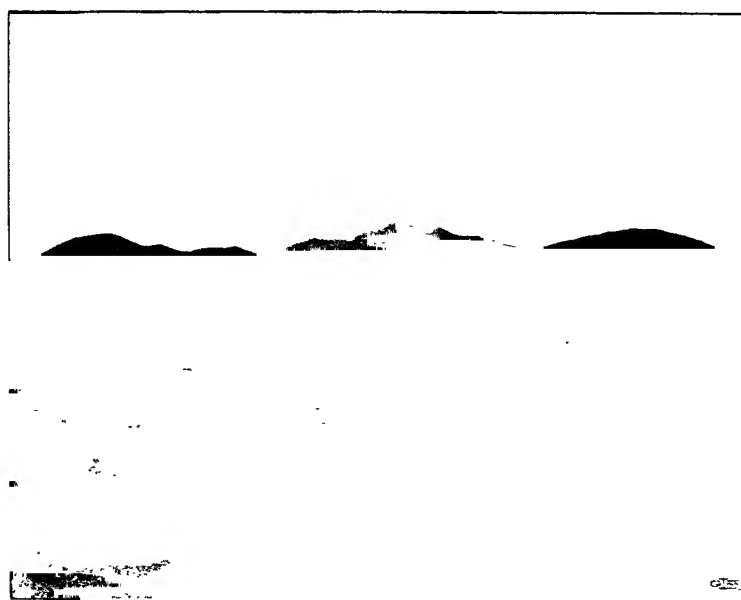


Fig. 42. IN THE SOFT UNDULATING PARTS OF UPPER TSCHIMEN-TAGH.

name, only carries water sometimes, as, for instance, after a fall of snow. After crossing over a succession of rounded heights, consisting exclusively of soft material, though frequently intermingled with fine gravel and fragments of sharp-edged stone, we descended into the Tschong-saj, a broad transverse glen coming down from the main range and terminating eventually in the Tschimen valley or in its continuation in the Tsajdam basin. Its direction here was N.  $20^{\circ}$  E., and from the right it is joined by a similar glen with a brook, likewise bearing the same name. The two glens of Dung-saj and K rk r ma, both traversed by brooks of running water, proceed towards the north, and are separated from one another by a secondary spur. East of this little ridge lies a trough-shaped collecting basin, seamed by innumerable watercourses, all of which gather into a larger glen running towards the N.  $20^{\circ}$  W., and bordered on the north-east by a larger spur composed of black rock.



Fig. 43. THE SAME.

After that we ascended to a flat pass, the water-divide between the last-named glen and the glen of Kara-tschoka, which runs S.  $75^{\circ}$  E. On our right, that is to the south, there was a prominent bluff, which we had to get round by travelling south, south-west, and west-south-west. Thereupon we continued on the flanks of this bluff, and advanced a short distance up the glen of Japkaklik-saj, shut in at its head by lofty, snow-capped peaks. There was only a trickling rivulet in the bottom of the glen. Owing to the heavy clouds our view was restricted, and only once or twice did we guess, rather than see, the beautiful mountain panorama to the east-north-east, with spurs jutting out *en  chelon* into the valley, which extends all the way to Puj. The altitude here was 3998 m., that is to say but little more than at the last camp.

This day it snowed again, and towards evening the snow fell in whirling masses, bringing with it a heavy precipitation. Some of my guides declared that at that season, that is in the middle of summer, it sometimes snows five days in suc-

cession. From one of the passes, had it not been for the universal prevalence of the black clouds, we should have been able to see the flat, dome-shaped summits of the Akato-tagh to the north, bathed in bright sunshine; for whilst the snow was accumulating in heaps on the Tschimen-tagh, the full heat of summer was being experienced in the adjacent Akato-tagh. The fauna remained the same, the skulls of arkharis and wild yaks being frequently met with.



Fig. 44.

All day the same crystalline rocks prevailed as hitherto, though it was only at about two places that the hard rock was within reach: for instance, at the pass of Dung-saj there was a fine-grained, black crystalline variety, dipping  $73^{\circ}$  towards the S.  $12^{\circ}$  W., and near the camp of Japkaklik a grey granite of extraordinary hardness. Otherwise the entire landscape consisted exclusively of the products of disintegration, in great part of soft yellow clay dotted with scrub and short grass. Yet fragments of granite and schist were always present in the bottoms of the watercourses. The main range of the Tschimen-tagh now began to dominate the scene on the south, its snow-fields having been richly augmented by the recent copious downfalls. We still continued, as we had hitherto done, to keep to the level at which the transverse glens gather up their remotest feeders. These, which are seldom very deep-cut in the soft earth, converge radially, until they give rise to larger watercourses, which are deeper, as well as in general surrounded by steep, rounded heights, over which it would be impossible to advance. Finally these secondary watercourses run together and give rise to the principal glens, which, more or less parallel to one another, seam the northern flanks of the Tschimen-tagh. It is between these glens that the wild and lofty spurs or ramifications rise to which I have alluded above. Consequently the easiest and most convenient part of the range on which to travel is the soft, undulating jajlak region immediately under the main crest, though that entails crossing at right angles all the watercourses which come down from the main crest. Lower down, where the streams become possessed of greater erosive energy and the rugged rocks crop out on the surface, the traveller is compelled to follow the deep glens. The annexed illustration (fig. 44) gives a typical transverse section of the orographical architecture to which I am alluding.

From Kara-tschoka a track leads to Puj (or Pschuj), a place inhabited by Mongols; the track is said to cross the lower glen of Japkaklik. On the nearer side of Puj there is a small bluff with a lake at the side, known as Tamtschi. Both the glen of Puj and the glen of Japkaklik terminate in the extreme eastern end of the Tschimen valley. This, which is known to the Lopliks simply as Kakir, is reported to be paved with dry, level clay.

July 23rd. It snowed all night, but the morning was fair. At the considerable altitude to which we had then climbed the snow no longer melted away, but evaporated; by ten a.m. it was all gone and the ground soon became quite

dry. We had encamped at the spot where the brook of Japkaklik disappears amongst the gravel. Next morning it was partly frozen over, and it also reached farther down the glen. After continuing down the glen along the rounded slopes on its right bank, we turned to the south up Musluk-saj, doubling a butte of moderate size. In fact Musluk-saj, with which the Japkaklik-saj unites, is the larger glen of the two. The reason the united glen bears the name of the latter is no doubt because it is traversed by a perennial stream, while the Musluk-saj was at the time of our visit dry. The conjoint glen, which picks up subsidiary glens from both sides, runs towards the north-east. On the east of it rises the bluff of Tamtschi; its lake was not however visible from our route. Beyond Tamtschi,



Fig. 45. VIEW OF TSCHIMEN-TAGH FROM THE PASS OF JULY 17TH.

on the east, is said to be Puj, so that it will be the next big saj, a word which in this part of the country is employed to signify a transverse glen. We were steadily inclining towards the south-west. On our right we passed Kumluk-tschap, a head valley of the Musluk-saj. It was up one of these side-glens that we directed our steps, and eventually the ascent grew distinctly perceptible. That district is known as Kartschugha. The first pass we came to might easily be mistaken for the principal pass, but we soon ascertained that all the watercourses were still directed towards the north, as for instance Kalam-ottok. Shortly afterwards we approached another large pass. This time there could be no mistake about it: it was the principal pass (4269 m.) of the Tschimen-tagh, for to the south it commanded a magnificent panorama of the entire range of the Ara-tagh, stretching from east to west in one long snow-clad crest. But true snowy peaks, distinct and individual, were only visible to the south-west and south; to the south-east, on the other hand, the mountains were more rounded, though all alike snow-clad, so that the entire range produced an impressive effect. But the snow is perpetual on only a few of the peaks in the south-west: most of what we saw fell in the last snow-storm, and in the afternoon it began to disappear on the flanks exposed to the sun.

The southern descent from the pass is remarkably short and yet gentle, and when we at length got down into the broad latitudinal valley which runs along the southern foot of the Tschimen-tagh, parallel to the Tschimen valley, this latter range wore the appearance of a series of insignificant hills, and neither bare rock nor snow-capped peaks were any longer visible. It was only in the distant east-south-east that we saw a larger snowy mountain, forming the continuation of the Tschimen-tagh; it is said to overhang the district of Kum-bulak, inhabited by Mongols.

Down the middle of the latitudinal valley a broad, brown strip made itself very conspicuous: it was the shallow bed of the stream which flows to the west. On the south it is bordered by slightly undulating ground, tinted green, and there we saw in several places wild yaks, kulans, and antelopes.

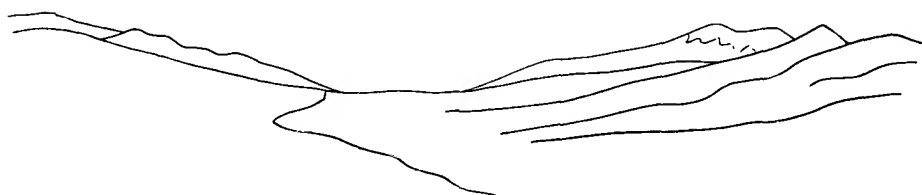


Fig. 46. A SNOWY SUMMIT OF THE TSCHIMEN-TAGH AS SEEN FROM ITS SOUTHERN LATITUDINAL VALLEY TOWARDS THE N 47° W.

During the day's march soft formations predominated as far as Kartschugha, but there hard, grey granite again came to the surface. Shortly afterwards it was succeeded by black schists, which dipped  $61^{\circ}$  towards the S.  $35^{\circ}$  E. and had an easy slaty cleavage. Close to the first secondary pass there was a coarser schist dipping  $30^{\circ}$  towards the S.  $30^{\circ}$  E., seamed with white dykes and veins. Very often the schist crops out in the bottoms of the watercourses, though it is in part so far pulverised that it is like small coal. Near Camp No. XII the core of the mountains consisted of coarse-grained granite with a reddish tinge.

## CHAPTER III.

### OVER THE ARA-TAGH AND THE KALTA-ALAGHAN.

The latitudinal valley in which we now encamped had, I was told, no other name except Kajir, a word generally used to indicate a broad and large valley, traversed by a shallow stream. In this case the stream is known as Kajir-darja. The present valley, which is situated between the Ara-tagh and the Tschimen-tagh, is



Fig. 47. DESCENDING A STEEP SLOPE.

said to begin in the district of Kum-bulak, where it is separated from Kak-kija on the east by a low ridge or threshold. Later on we shall make a nearer acquaintance with the lower part of this latitudinal valley, which had brought us up another step nearer to the Tibetan plateau. Thus in the case of the Tschimen-tagh the excentric formation is still more pronounced than in the ranges that lie to the north of it. Its principal pass is situated only a few hundred meters from its southern foot,

but a good two days' journey from its northern foot; in fact it hardly seems to belong to the range proper, but rather to a rounded swelling immediately south of it. In other words the Tschimen-tagh appears scarcely to possess any southern slope at all, but is entirely buried under the soft material of the Kajir valley. The altitude of Camp No. XII was 4185 m., or only 84 m. lower than the principal pass of the Tschimen-tagh.

July 24th. The stream in the Kajir valley carried a volume of 2 to 3 cub.m. in the second, and the fall seemed to be steeper than is usual in these great latitudinal valleys. From the south this valley was joined, in the neighbourhood of our camp, by several side-glens, though only two of them, both running towards the north-west, were at that time traversed by running streams. At the same place the principal valley extends to the N.  $64^{\circ}$  W. Thence too we perceived to the N.  $47^{\circ}$  W. in the Tschimen-tagh a lofty snowy peak surrounded by several others of minor elevation. It is there, on the northern slope, that the Korumluk-saj is said to originate.

At first the ascent was very slight, but gradually the steepness increased, the ground at the same time undulating gently. The surface consisted of soft, fine soil and produced some grass. At length we reached the foot of the mountain. Here we passed the narrow ravine of Ungur-tschap with a brook. The name is derived from a small grotto (*ungur*) in the schists on the left-hand side of the ravine, in which hunters sometimes spend the night. The brook that came down this glen carried a volume of about  $\frac{1}{5}$  cub.m. in the second, and the water was beautifully fresh. Nothing but an insignificant spur of the mountains separates this ravine from the glen of Ak-tschoka. It was by the last-named glen that we climbed up to the pass of the Ara-tagh, Ak-tschoka-aj-tuse, a flat and easy *bel* or col at an altitude of 4373 m. From its summit we commanded a fine view of the next conspicuous feature in this highland region, namely the culminating range of the Kalta-alaghan, with its host of lofty snow-capped peaks. But below it and on the nearer side there is another latitudinal valley, parallel with the one which we had just climbed up out of, and known as Kalta-alaghaning-kajiri. Farther west the two valleys unite, for the Ara-tagh dwindles in height until it disappears not very far away. In this way the united valley, having passed the western extremity of the Ara-tagh, has the Tschimen-tagh on the north and the Kalta-alaghan on the south, and finally it enters the Tschimen valley. From the pass in the Ara-tagh we had therefore a splendid view of the Tschimen-tagh. In the east it is surmounted by several dominating snowy peaks. So long as we were down in the latitudinal valley the gentle crest, with the pass that serves as the water-divide, had screened the craggy bluffs of the Tschimen-tagh from our sight; but from the pass of the Ara-tagh we now saw them standing out sharply and distinctly.

On the other side the pass of the Ara-tagh descends towards the south-west, and is shut in by considerable heights, and lower down, after it has been joined by a number of side-glens, it becomes converted into a deep gorge, bordered by terraces of gravel-and-shingle.

In the Ara-tagh again the southern face is shorter and less steep than the northern face, though the difference is far less accentuated than in the Tschimen-

tagh. The transverse glen strikes the main glen at S.  $87^{\circ}$  W. To the south-west there is a gap in the crest of the Kalta-alaghan, through which runs a pass that is said to be easy to negotiate, and with an abundance of water, grazing, and fuel. We however proceeded up the main glen towards the S.  $65^{\circ}$  E. The stream that courses down it is divided into several arms, and at that time carried a volume of at least 5 cub.m. in the second; its flow was a good deal swifter than that of the brook in the preceding latitudinal valley. But then the southern valley lies higher, and the two streams effect a junction. Just at the point where we struck up a side-glen running to the south-south-east there was, in the main glen, a patch of soft, white ice, perhaps 1 km. long and at the most 150 m. broad. This shows that in the autumn and winter the stream must freeze and form a huge sheet of ice, which thaws again in the spring and summer; and, end of July though it was, there was nevertheless this large patch still remaining.

Our side-glen too was broad and open, and surrounded by jajlaks, on which large troops of kulans were grazing. On the east of the glen were soft, low hills and to the south-west of it a huge mountain-massiv (F.) with snow, whence a couple of brooks came down to join our glen. After crossing the stream that flowed down our glen, we left its *baschi* on our right, that is the south-west, this likewise gathering off the massive F, its slopes and ramifications. Then, after surmounting a low ridge, we directed our steps towards the south, and crossed over a very deeply trenched and eroded glen with a couple of cub.m. of muddy water. This brook runs towards the N.  $80^{\circ}$  E., and joins a larger stream that flows between the two masses F and G. This last formation rose immediately east of our route and formed a rather low, furrowed talus slope, with snow at the top; a little farther east there was another similar mountain H. Along the northern side of both flows a large brook, which joins the main stream by the left or western bank of which we were ascending. From both sides this is joined by a number of minor rivulets. After all these small brooks have mingled their waters together, they form a pretty large stream, which flows towards the north and north-west between terraces of gravel-and-shingle. Eventually it enters the large river that flows down the latitudinal valley between the Ara-tagh and the Kalta-alaghan.

To the north we now commanded a view of the entire summit of the Ara-tagh; yet as compared with the neighbouring ranges it presented but an insignificant appearance. Its more rounded crest was overtopped even by the higher parts of the Tschimen-tagh.

The hard rock was visible at Ungur-tschap, namely a hard mica-schist, dipping  $23^{\circ}$  towards the N.  $75^{\circ}$  E.; higher up it dips  $42^{\circ}$  towards the N.  $60^{\circ}$  W. Ak-tscho-ka-aj-tuse is a rounded flattened pass of soft material, but on both east and west, more especially on the east, it is flanked by lower, sharper summits without snow. On the right side of the latitudinal valley between the Kalta-alaghan and the Ara-tagh there are knolls and hilly terraces of coarse grey granite. On the opposite side of the valley there is a very hard, dark, crystalline schist, dipping  $83^{\circ}$  towards the N.  $50^{\circ}$  W. and later  $78^{\circ}$  towards the S.  $40^{\circ}$  E. In the deeply trenched valley south of the little ridge or threshold the hard rock is nowhere visible, although big blocks of granite peep out from the soft material on the slopes. At Camp No.



XIII there was, dipping  $72^{\circ}$  towards the S.  $40^{\circ}$  E., a hard variety of rock, which emitted sparks when struck, and had a conchoidal fracture.

July 25th. From Camp No. XIII we proceeded up the slowly rising side-glen which leads to the pass of Avras-davan in the crest of the Kalta-alaghan. Along its bottom trickles a little rivulet. The principal glen, which we thus left on the east, comes from the south-east, from loftier parts of the Kalta-alaghan and its northern spurs.

The view which opened out south from this pass (altitude, 4786 m.) was very different from those we had obtained from the northern ranges. Instead of a single distinctly outlined parallel chain, the scene was perfectly confusing from the multitude of peaks, crests, ridges, and ranges, that met the gaze; to unravel them all and map them properly would be a work of months. A reconnaissance such as that of mine, confined to one single line across such a mountainous chaos, can offer but a small contribution towards the solution of the problem. The details in the immediate vicinity of the route are correct; but with regard to the relief of the country farther away on both sides I was frequently in uncertainty. The first objects that arrest the eye, looking from the pass, are three gigantic snowy complexes, which stand out in a particularly conspicuous fashion. In the S.  $21^{\circ}$  E. was the culminating point of a gigantic snowy range stretching from east to west, while due south we observed an isolated snowy bluff, forming apparently a continuation of the former. In the S.  $11^{\circ}$  W. there was yet another snow-capped range, lying along the prolongation of the first two. All these chains rise south of the basin the deepest part of which is occupied by the two lakes of Kum-köl; but neither of these is visible from the pass of Avras-davan, owing to their being masked by various lower heights. Between the Kalta-alaghan and the southern snowy range there are several other ranges, partly spurs and ramifications of the first-named, and partly parallel chains lying between the two principal systems. In the far off distance we could just make out on the southern horizon, though with difficulty, another snowy crest, barely distinguishable from the white clouds: this consequently overtops every other range within sight. It was the Arka-tagh, the loftiest range containing practicable passes, not of Asia only, but of the whole earth.

From the pass we descended due south by the glen of Avras, which was at first pretty steep as well as gravelly; but gradually it widened out, the surface at the same time growing leveller, and finally emerged into a main glen coming from the east and traversed by a small rippling rivulet. On some of the adjacent slopes we found fuel. To the north-west and west was a gigantic wing of the Kalta-alaghan, crowned by several snowy peaks, though their flanks were perfectly black, and they are footed at their base by rounded heights that fall away towards the bottom of the new latitudinal valley.

Just above the pass of Avras there was a thick dyke or vein of diorite (?), stretching from S.  $50^{\circ}$  E. to N.  $50^{\circ}$  W. Immediately south of the pass was porphyry, which a little lower down was bedded at an angle of  $63^{\circ}$  to the S.  $70^{\circ}$  E., and lower still at  $67^{\circ}$  to the S.  $10^{\circ}$  W.;  $87^{\circ}$  to S.  $10^{\circ}$  E. and  $82^{\circ}$  N. We made Camp No. XIV (4477 m.) at the point where the glen of Avras joins the upper part of the latitudinal valley. There the left side of the stream that flows down the latter

is formed by several hills, half broken down and carried away by erosion; thus they present steep faces towards the stream, but otherwise are soft and rounded, and covered with scanty vegetation. The hill nearest to us was composed of a very fine-grained, weathered rock, dipping  $87^{\circ}$  towards the S.  $50^{\circ}$  W. and  $68^{\circ}$  towards the N.  $10^{\circ}$  E.

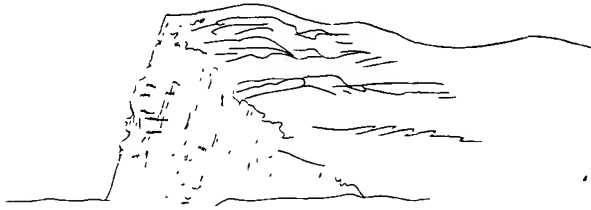


Fig. 48. STEEP HILL AT KARTSCHUGHA-BULAK.

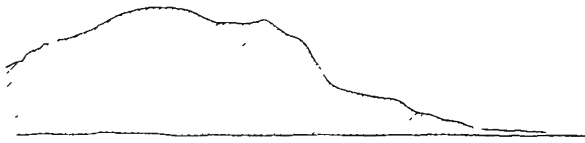


Fig. 49. ANOTHER HILL AT KARTSCHUGHA-BULAK.

The district around Camp No. XIV is called Kartschugha-bulak. A big bluff in the S.  $7^{\circ}$  E. is known as Takta-pärä, and another in the S.  $10^{\circ}$  W. as the Tschulak-akkan. These two names do indeed occur in that district, as we shall presently see, but it is rather doubtful whether they were correctly placed by my guides. The Kalta-alaghan is the sixth of the parallel ranges we crossed over on our way up to the highland region of northern Tibet, the route having led over the Lower and Upper Astin-tagh,

the Akato-tagh, the Tschimen-tagh, the Ara-tagh, and the Kalta-alaghan. This last closes the first series of parallel ranges that are separated by latitudinal valleys sloping generally towards the east. South of the Kalta-alaghan the scenery so far changes that the next latitudinal valley is more like an immense basin, with a large salt lake in its lowest part. At Kartschugha-bulak the term latitudinal valley is indeed still appropriate, but soon afterwards the valley expands into the Kum-köl basin. The map of the Russian General Staff of this region urgently needs revision. Even in its broad features it does not correspond to the real state of things; for it shows the Ara-tagh as a continuation of the Kalta-alaghan, which is erroneously designated the Kalga-Lagan. This puts the Avras-davan in the Ara-tagh instead of in its true place in the Kalta-alaghan, though there may of course be two passes bearing this name. The same confusion prevails with regard to the nomenclature. Prschevalskij, without having the slightest pretext for doing so, calls the Tschimen-tagh by the name Tsajdamskij, though its eastern part is designated Japaklik (= Japkaklik). If this latter name is in use at all, it surely renders the term Tsajdamskij superfluous, to say nothing of its being a very unfortunate choice from the geographical point of view. On the other hand the name Tschimen-tagh is printed across the Akato range, this too being drawn altogether erroneously. Seeing then that so many of the names, which I was in a position to check, are wrong, it is impossible to repose much confidence in the others that I have not checked. For instance, in the true Tschimen-tagh the map gives two peaks, which it calls Ikhin-gasin-khorgu and Iskhin-gansi-khorgu. These, one strongly suspects, are identically the same name, spelled wrongly in one of the two cases. On the same map we find also the name Tokta-pera, a name which I also heard used; but on the map it indicates a peak which in Mongolian is called Dschinri (Jing-ri) and is made to belong to the Ara-tagh, whereas in any and every case it must of necessity lie,

to say the least, a long way south of the Kalta-alaghan. To this last Prschevalskij gives the name of Columbus Range, which again is unnecessary, seeing that the range already possesses its own native name, well known to all gold-prospectors and yak-hunters. From the 1899 edition of the Russian map this name has, rightly enough, been deleted; but it occurs, I am sorry to see, on map 62 of the 1902 edition of *Stieler's Hand-atlas*. On Pjevtsoff's map the Kalta-alaghan bears four names: Ambal-aschkan, Kalga-lagan, Ara-tagh, and Columbus, the last being applied to the range as a whole. To the western part of the Akato-tagh Prschevalskij gives the name Tschamen-tagh, while the eastern part he calls Besimennij (= the Nameless), but delineates it as running north-east and uniting with the Astin-tagh. The direction is shown a little more accurately on Pjevtsoff's map and on the map of the General Staff, but is still to a large extent imaginary. Of course all these errors are repeated in the ordinary European atlases. I cannot of course pretend to correct all these errors in detail; I must content myself with pointing out that in respect of both its orography and its morphology this part of Northern Tibet might previous to my visit have been looked upon as to some extent almost a *terra incognita*.

July 26th. Our route now ran westwards in the direction of Kum-köl, almost at right angles to the track we had followed over the Kalta-alaghan. Once or twice we caught glimpses of the lake, but as we dipped down into lower ground it became hidden behind the irregularities of the ground. Thus we were now travelling in a gigantic latitudinal valley stretching along the southern foot of the Kalta-alaghan, from which black spurs and other ramifications, with an occasional snowy peak, jut out into the valley. On the south the valley is bordered by an extensive drift-sand area, with dunes, which when seen from a distance resemble a low, yellow mountain-range. The dunes therefore rise to a pretty considerable height, and are absolutely barren. The northern margin of the drift-sand area is wonderfully sharply drawn, and runs from east-south-east to west-north-west. Although we were travelling west, with a slight inclination towards the north, we were nevertheless approaching nearer to it, for we were marching diagonally across the valley. At the beginning of the day's march, when we were still pretty high up, we observed dark rocky bluffs projecting as it were through the sand, though they were no doubt as a matter of fact behind it. As we advanced, we left behind us the vast snowy range the three culminating points of which I had noted from the pass of Avras. One of the three, probably the middle one, must be identical with Prschevalskij's Schapka Monomacha. The names Tschulak-akkan and Takta-pärä, which I have already mentioned as designating mountains north of the lofty snowy range, are also said to belong to streams in the same vicinity. The Tschulak-akkan appears to be the upper course of the Batugantu-gol, which enters the Tsajdam depression at Hadschir. It is in one of its southern side-glens that the gold-mines of Bokalik are situated, a place well known to all Lopliks, and also visited by the inhabitants of Kerija. According to Roborovskij's map the springs of Tschulak-akkan are situated on the northern slope of the Schapka Monomacha. Carey and Dalgleish, who journeyed through this glen, call it Tsagan-tokhoj, its Mongolian name. The name given to it by the Mussulmans is said to be derived from a man Tschulak (= the Cripple), who formerly dwelt there. On the north this glen is said to be joined by another glen bearing the name of Takta-pärä

(Jing-ri or Dschinri), which proceeds from the bluff of the same name. The delineation of this region by Carey and Dalgleish is clearer and more intelligible than Roborovskij's; indeed it is pretty plain, without having visited the locality, that the map of the latter is for this particular section artificially constructed. The material available is not however sufficient to give us a clear idea of the orography as a whole, to say nothing of it in detail. One thing however is evident, namely that between the valley of Kum-köl and the river of Tschulak-akkan there must be a water-divide of some kind, which possesses great morphological importance, for it must form the boundary between the basins of Kum-köl and Tsajdam. The swelling in question is possessed of the same significance as that which separates the river Tschumar or Namchutu-ulan-muren from the Tibetan highlands south of the Kokoschili range. And Carey and Dalgleish do indeed show it as a distinct swelling, situated south-east of what they call the Sandy table-land, which corresponds to the drift-sand area I have alluded to above. They are consequently entitled to the merit of having given to the Tschong-kum-kul its proper position and dimensions. On Roborovskij's map not only the neighbourhood of the lake, but also the mountain-ranges that rise to the south of it, are altogether distorted, as I shall show more fully in the sequel.

At the beginning of the day's march we had on our left only one subsidiary offshoot from the mountains, and it soon died away westwards into low hills. On the other hand the Kalta-alaghan extended as far as we were able to see towards the N.  $65^{\circ}$  W., and in that same direction several snowy peaks appeared to lift themselves above its crest. The latitudinal valley slopes, as I have already said, towards the west; its surface is soft and sometimes strewn with a sprinkling gravel from the Kalta-alaghan, and likewise produces grass, and hard woody teresken and similar scrubby plants. We passed only two or three small rivulets running down from the mountains, and they speedily disappeared in the dry soil. These originate no doubt in springs, for all the other watercourses, most of them very shallow, were dry. Only two or three were as deep as 3 to 4 m., and even their banks were not sharp-cut or terraced, but rounded. Where we crossed over them they were running towards the west-south-west, but gradually inclined towards the west; and supposing them to be powerful enough, they ought to converge to form a main stream that empties into the eastern end of the Upper Kum-köl. But as a matter of fact they dwindle away before reaching the lowest part of the valley; consequently this possesses no main drainage artery, unlike the valley between the Tschimen-tagh and the Ara-tagh and that between the Ara-tagh and the Kalta-alaghan.

On the left, that is to the south, we had all day the drift-sand area, the highest pyramidal dunes of which are situated well towards the centre of the area. To what extent they are composed of pure drift-sand it was impossible to determine, for it is quite conceivable that the irregularities of the ground, hills and smaller heights, which may have been covered with sand, may make them appear bigger than they in reality are. It was equally difficult to make out with certainty in what direction the steep faces of the dunes looked; so far as I was able to judge from our route, most of the dune-crests run from north to south and their steep faces are turned towards the east, so that the latest predominant wind that blew would



*Illustr. A. B. Lagrelus & Westphal.*

LOOKING E. N. E. FROM BULAK-BASCHI.

In the background Kaltu-daghban.



appear to have come from the west. Nevertheless the steep and frequently irregular shape of the dunes suggests that the east wind also prevails during a part of the year. Both the orographical relief and the direction of the latitudinal valley render it probable that the east and west winds are the strongest, and the sharpness with which the drift-sand area comes to an end likewise indicates that the winds from these two predominant directions are about equal in point of strength. Hence this sandy area is stationary, like the Kum-tagh south of Pitschan, and within its area the dunes travel over a limited distance, backwards and forwards, and not exclusively in one direction like the dunes of the Desert of Lop. Meanwhile the sand goes on accumulating within its area, and the dunes gradually increase in height, the material being derived from the disintegrating mountains on the east and the west.



Fig. 50. THE CAMP AT BULAK-BASCHI.

Animal life was represented by kulans, of which immense troops were grazing all over the scattered patches of grass. The other animals consisted of marmots (*davaghan*) and hares of a steel-grey colour with white under-parts.

The only places in which we observed the hard rock were in two or three promontories of the Kalta-alaghan at the beginning of the day's march, namely a grey granite, strongly inclined to pink, and with moderate-sized grains, as well as green porphyry; and the gravel which in places littered the bottom of the valley consisted for the most part of the same rocks.

We made Camp No. XV at Bulak-baschi, where, as the name indicates, the first springs are situated. The altitude amounts to 3922 m., indicating a pretty considerable fall of the valley down to the Kum-köl. On the 27th July, after proceeding a short distance south from the first two small pools beside the springs, we subsequently travelled for the rest of the day west-north-west along the northern edge of the drift-sand. On our right we had an uninterrupted string of marshes and pools, containing bright, fresh spring water, and all more or less connected together by means of short sounds or streams. Even when the water did not actually lie on the surface, the ground was so soft and moist that we sank into it, and consequently we had to march quite close to the edge of the sand, sometimes crossing small off-



Fig. 51. VIEW LOOKING NORTH FROM BULAK-BASCHI.

shoots from it. To ride across the marshes would be impossible at that season. This paludal region derives its water from innumerable springs, which gush out some from underneath the sand, others from the faces of the terrace-like ledges and platforms of the earthy foundation upon which the dunes have accumulated, and which is soft, moist, and clothed with grass. Of the former class of feeders six were in especial of some size, each of them carrying, I dare say, a volume of  $1\frac{1}{2}$  cub.m. in the second. These small watercourses are to be regarded as ordinary brooks flowing in the usual eroded channels on the surface, the peculiarity being that for a considerable part of their course they are smothered in drift-sand, which without actually preventing their flow, naturally serves in a high degree to retard it. At the points where these underground streams emerge from beneath the sand, its otherwise regular contour is cut into by a pretty deep indentation. Nevertheless the water when it emerges is absolutely as bright as crystal, and not in the slightest degree muddied. All the same there must be fine dust in the sand, but the bases of the dunes which cover the basin have been unmoved and immovable for centuries,



and the finest particles which they formerly contained were long ago washed out of them. Once they have emerged, these brooks flow along rather shallow beds, the bottom of which consists of hard clay, and are fringed by short but luxuriant grass. Generally at first they incline for a short distance to the north-east before definitively assuming their west-north-west direction, soon after which they as a rule empty themselves into a larger or smaller pool, though the biggest of these is only a couple of hundred meters long. A considerable distance farther west however a main artery appears on the southern side of the latitudinal valley and, after gathering up all this spring water, enters the lake by numerous deltaic arms, in this way securing a constant flow into it. During the last part of our day's march this main artery was however joined by no tributaries, although there were at the same time several unconnected pools of spring water between the stream and the northern edge of the sand.



Fig. 52. LOOKING EAST FROM BULAK-BASCHI.

The marshes and pools are surrounded by short, luxuriant grass, growing upon mounds or hillocks and hanging over the water, in the way shown in the accompanying sketch (fig. 53). In the water I observed a small greyish yellow Crustacean. The grass continued in places, although thinly, as far as the lowest slopes of the dunes, but did not advance any higher. The northern border-line of this belt of grass-grown marsh is sharply differentiated from the saj, or gravelly slope, which stretches down very gently from the southern flank of the Kalta-alaghan.

The hydrographical relations on the south side of this latitudinal valley are thus masked by the drift-sand area. However the hydrography seems to be as follows. The stream which flows into the Upper Kum-köl is fed exclusively by perpetual springs situated to the south; from the slopes of the Kalta-alaghan on the north it receives no contribution from perpetual springs, only at the most rain-water after an occasional shower. The snow which the Kalta-alaghan arrests is for the

most part accumulated on its northern flank, where we found a much greater quantity than on the southern flank. The snow-water and the water from the springs flow down for the most part to the latitudinal valley on the north, the southern slopes of the range being relatively dry. It is true that from Kum-köl several snowy peaks are visible in the west of the range; all the same the quantity is insignificant as compared with that on the north. The snow with which those peaks are capped soon melts in the sun, and is insufficient in quantity to give rise to rivulets capable of reaching down to the southern latitudinal valley. On the south however the circumstances are quite different. The two lakes of Kum-köl fill the lowest part of one of the largest self-contained (internal drainage) basins of the Tibetan highlands. The mountain-ranges which border this basin on the south are much higher than the Kalta-alaghan, and all the rain and snow that they arrest ultimately finds its way down into the Kum-köl lakes. As we shall see subsequently, it is the stream that connects the Upper with the Lower Kum-köl, and the Lower Kum-köl itself, that receive the larger number of these mountain-streams, which gather off the northern slopes of the Arka-tagh or its northern foot-hills; and some of them carry quite considerable volumes of water in the summer. The lower course of one such stream, or perhaps of several such, has been retarded by the drift-sand I have mentioned, which completely hides it from sight. But as for a considerable distance along the northern border of the sand there issue a succession of rivulets and springs, the inference is suggested, that the watercourses which come from the south are spread out like a delta underneath the sand. But however that may be, it is certain, that the water which disappears under the sand at its southern edge reappears in springs at its northern, and the rivulets to which it gives rise in consequence of the retarding action of the sand carry water all the year round, whereas the original stream only carries water during the summer.



Fig. 53.

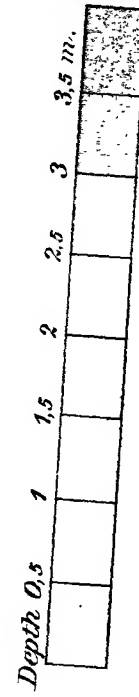
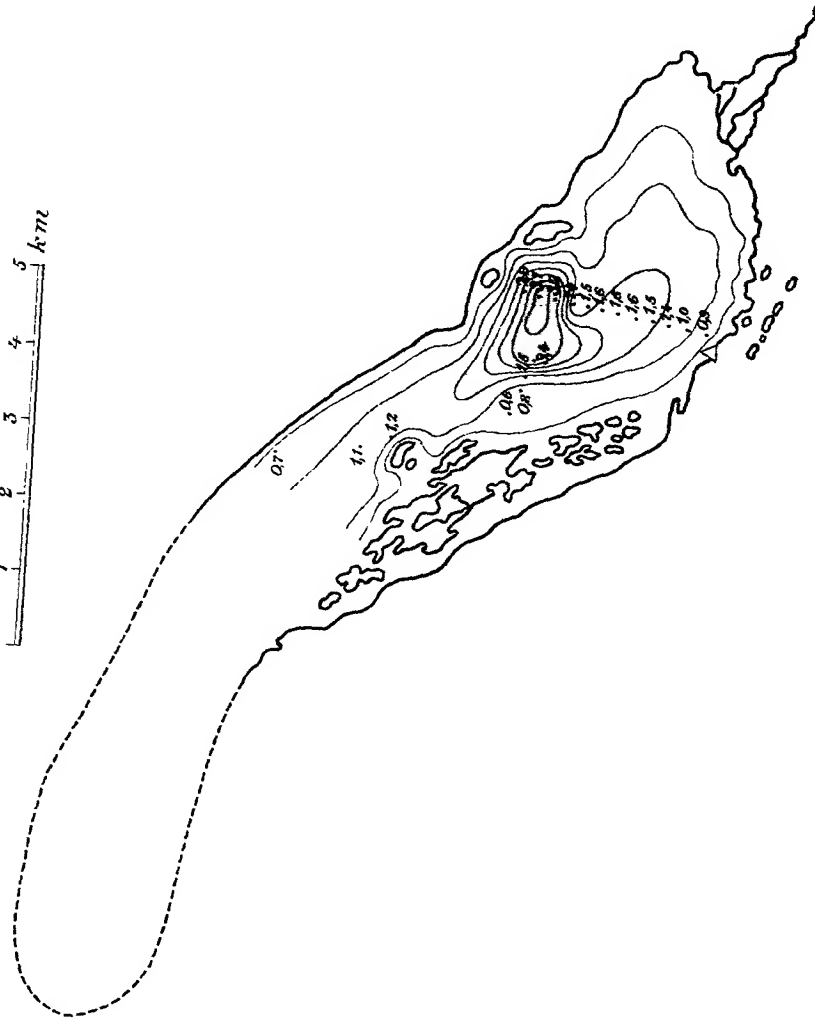
According to my guides, the narrow strip of firm ground between the sand and the marshes upon which we were marching was the only practicable route. We might, it is true, have travelled on the north

side of the marshes, but in order to reach the southern shore of the Upper lake that would have necessitated our crossing the stream in its lower part, a thing considered impossible at that season of the year because of the soft and treacherous nature of its banks. It was equally difficult to march along the northern shore of the lake and then cross the stream that connects the Upper with the Lower lake; and in a later excursion we learnt that the ground there too refuses to bear a man on horseback, and even refuses to bear a man on foot.

Although it would have taken a long time, I should have liked to examine more thoroughly the drift-sand area; but from this I was deterred by the advanced season of the year and by the wish to penetrate as far south as possible into Eastern Tibet before winter began. I had therefore to content myself with mapping its outlines on the sides where we touched it, namely on the north and west. With regard to the height of the dunes, I am unable to offer any precise measurements; but they appeared to me to be as high as the dunes at Jangi-köl, namely 80 to

# Isobathic map of Basch-kum-köl

Scale 1: 100000





90 m., and in the middle of the area may easily have been more. In the western half of the area it was plain that the leeward slopes face the east; and very often they plunge down to the bottom of the valley with a strikingly precipitous descent. Altogether there are only one or two small patches of saj, that is hard and barren ground, with a thin scattering of small gravel. These patches of saj also stretch slowly down towards the marshes. The deepest part of the valley lies however quite close to the edge of the sand. Consequently the base upon which the sand rests likewise has a gentle slope towards the north and north-west, and occupies pretty nearly one-half of the breadth of the valley. In the west the lake presented the appearance of a small glittering expanse. Over against its southern shore the sand is very considerably less in altitude; to the west of our Camp No. XVI the dunes were low and small.

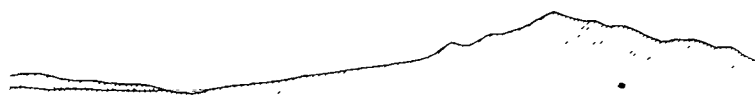


Fig. 54.

At 3.30 p.m. a violent storm from the south-east set in, a violent wind accompanied by hail and pouring rain. One would expect that a beating, driving shower such as that would at any rate tone down and to some extent wear away the sharp crests of the dunes; but the rain-drops are unable to do more than dimple the surface of the sand, and even the little shallow holes which they make in it are not seen except upon a close examination. Otherwise the shape of the dunes, and the sharpness of their outlines, are in no degree affected by the rain; they merely assume a slightly darker tint. Nevertheless there is every reason to believe, that after such a rain, which must penetrate pretty deeply into the dunes, their movement will for some time, even though it be for only one or two days, be in abeyance. In any case it is extremely interesting to find that the origination of continental dunes is practically quite independent of the absolute altitude above the sea and of the climate. This idea is suggested by a comparison between the Kum-tagh that stretches south of Pitschan and this drift-sand area south-east of the Kum-köl. The former occurs in an excessively arid region, a perfect desert in fact, lying but little above the level of the sea. The latter exists in a mountainous country more than 4000 m. above the level of the sea, and where there is a considerable precipitation. Were it not for the moisture of the atmosphere there would originate here a sandy desert, which would eventually fill up the whole of the basin of Kum-köl.

The violent alternations of weather, with its abrupt changes, that is characteristic of Tibet were even more noticeable in the basin of Kum-köl than in the Tschimen valley. For instance, at noon the thermometer would stand at 20° above zero and the atmosphere would be perfectly still and bright, and yet only a short while afterwards the valley would be swept by a violent wind and an icy hail-shower. The atmospheric moisture increases not only with the altitude, but also from north to south.

The occurrence of this violent change in the weather afforded us an opportunity to note a curious effect produced in the animal life of the region. So long

as the air was warm and still, it swarmed with mosquitoes and gad-flies. The latter, called in that locality *ila*, are wont to fasten themselves in the nostrils of the horses, kulans, and other animals. The kulans however appear to be either less sensitive to the attacks of the tormenting insects or else they possess some means of protecting themselves against them: the natives at any rate declare that, when the kulans are attacked by the gad-flies, they put their noses to the ground and keep their nostrils hidden amongst the grass. The orongo antelopes (*jurgc*) avoid the steppes during the day and take refuge amongst the dunes; in fact we observed four herds, consisting of 11, 13, 2, and 4 individuals respectively. And the wild yaks too protect themselves in a similar way, only they go farther in amongst the sand-dunes, so that we did not see them from our route: but their footprints were extraordinarily numerous, both going up into the sand and returning from it, and there were great quantities of yak-dung all along the foot of the sand. If the weather remains fine all day, the antelopes and yaks do not descend to their grazing-grounds until sunset or shortly after, when the gad-flies have disappeared. But now, the hail-shower and the rain having put the gad-flies to flight earlier than usual, the yaks showed themselves on the summit of the highest dunes: and as they stopped to survey the scene before descending, they made in truth a magnificent sight. There were also several yaks on the pasture-grounds at the east end of the lake and on both sides of the delta of the stream. In spite of the great weight of these animals, they appear able to cross treacherous boggy ground, into which a horse would sink and become irretrievably lost. The kulans however avoid ground of that description; and of this fact the wolves, which, I may remark, are especially numerous in the Tschimen and Kum-köl valleys, are said to avail themselves when they chase the kulans. As if acting upon a previously prepared plan, they drive their selected victim out into the marsh, where the ground gives way under him, though it will bear the weight of a wolf.

On the south shore of the lake, where we made Camp No. XVI (3882 m.) the grazing was all that could be desired. The shore itself was rather moist. The lake stretches towards the north-west; but from the point where we were encamped it was impossible to form any conception of its size owing to the extent of flat ground around it. Its northern shore can however be seen rising, at first slowly, but afterwards more steeply, up towards the foot of the Kalta-alaghan, which continued westwards for as far as we were able to see, thrusting out sharply-outlined, short, rugged spurs towards the middle of the valley. In the east we could see quite clearly and distinctly the imposing bluff F. My guides stated that there were passes over the range on both sides of the peak R. The track which comes over the range by the pass of Kalta-alaghan-davan is said to reach the latitudinal valley just north of our Camp No. XV. This would make four passes altogether in that locality; but I have no doubt that the Kalta-alaghan can be crossed in several other places without any special difficulty, at least I should judge so from the great number of deep notches in the crest, those towards the west being generally nearly clear from snow. The pass of Ambal-aschkan-davan, farther west, was the one used both by Carey and Dalgleish and by the Prince of Orleans and Bonvalot. On a later excursion I tried a new pass, as well as another that was used by Prschevalskij.

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## CHAPTER IV.

### THE KUM-KÖL LAKES.

July 28th. The Upper Kum-köl was the first Tibetan lake that I investigated. How the investigation was carried out — it does not pretend to be anything more than a hasty reconnaissance — I will now describe, reserving for a subsequent section of this work a connected grouping and discussion of the different types of Tibetan lakes. I say deliberately, this examination was nothing more than a preliminary reconnaissance, because the series of soundings I took were all too few, and the number of soundings too few in proportion to the area of the lake, to give an accurate idea of the shape of its basin. In most cases the material I have gathered is sufficient to afford an indication of the appearance and general features of each individual lake, and as no such investigations have ever before been carried out in these lakes, my material, incomplete though it is, is not without value. I must also at the same time point out the tremendous difference between the circumstances under which a lake is sounded and mapped in, for instance, Switzerland or Scotland and those under which I had to work in Tibet. Generally the grazing in the vicinity of the Tibetan lakes is so wretched that out of regard for your caravan a prolonged stay beside them is impossible. Add to this the perpetually recurring and violent storms, which either interrupted, or rendered very difficult, almost all my lake excursions in Tibet. As I had at my disposal only a small canvas skiff, to hold two men, our first thought, on the outburst of a storm, was of safety rather than of scientific work. Since, then, the material which I shall give lower down was obtained at such great risk and under such unfavourable circumstances, it will probably be acknowledged that its value is rather enhanced on that account.

The first series of soundings in the Upper Kum-köl was made from the southern shore towards the N.  $13^{\circ}$  E., our course being steered by one of the snow-capped peaks of the Kalta-alaghan. Along this line the breadth of the lake was only 3.2 km., and at approximately equal intervals we obtained successively the following soundings — 0.89, 1.04, 1.42, 1.50, 1.63, 1.62, 1.58, 1.50, 1.40, 3.42, 3.73, 2.94, and 1.45 m. In this the eastern end of the lake, where it appears to be broadest, the depth nowhere reaches 4 m., and it is consequently very shallow, shallower even than the marsh of Karakoschun, though its mean depth would appear to be rather greater. To judge from

the excessive flatness of the shore, I should say that in all the part of the lake which lies east of the line we sounded the depth is no greater. The bottom of the lake is carpeted with Algæ, which impart to the water a dark green shade, though in places there are strips of bare ground, where the sand tinges the water a light yellow when seen from the distance. The gravelly scree of the Kalta-alaghan comes right down to the northern shore, and even covers two small islands, which lie off it; the smaller of these measured only 30 m. in diameter.

With the wind blowing hard we continued towards the south-west to about the middle of the lake, where the depth was 3.40 m.; but from that point we had to drift with the wind and the waves, and along the stretch we then covered the depth continued steadily to decrease, the soundings being 1.46, 0.85, 0.84, 0.82, 0.78, 0.62, 1.00, 1.05, 1.20, 1.20, 1.10, and 0.70 m. Consequently this lake is little better than a thin sheet of water spread out over an almost horizontal surface. At the point where the gale compelled us to turn the lake contracted until it was like a bay or river estuary, though to the north-west it appeared to extend as far as the blinding rain would let us see, and indeed it is said to stretch a very considerable distance in that direction. In the western half too it is said to be very narrow in some places. The southern shore, by which we returned, consists of black mud or ooze, and that too is the constitution of the lake-bottom, for when we poked it up with our paddles, it came floating up to the surface like a dark flocculent cloud. Gradually the mud was succeeded by the grassy steppe that borders the lake on the east. The mud is no doubt derived from some of the southern rivers, for in summer they carry pretty large volumes of turbid water, and probably in time they will fill up the lake. To what extent that really is so I do not know, for when I left Camp No XVI. I struck south, and have never visited the western half of the lake. According to Roborovskij's map the stream which connects the Upper with the Lower Kum-köl is joined from the south-east by a triple tributary called Tumenlik-su, which issues from the Tumenlik-tagh, the Ischak-kaschti, and the Chal-saj, offshoots of a mountain-range likewise known as the Tumenlik-tagh. Carey and Dalgleish, who, unlike Roborovskij, have travelled beside the stream in question, give on their map a very different picture of that region. According to them the stream which empties into the western part of the Kum-köl originates, like the Tschulak-akkan, in the spur called Schapka Monomacha. According to Roborovskij the united stream is called Bulak-baschi. The name Tumenlik-tagh ought no doubt to be Tömürlik-tagh, for that is the form in which I heard it.\*

As I only visited the eastern part of the Upper Kum-köl and the whole of the Lower Kum-köl, but not the country lying between, I am unable to give any absolutely certain idea of the hydrographical connection between these two lakes. Yet by combining the results of the maps by Carey, Bonvalot, and Roborovskij with my own experience I believe I can make a pretty near approximation to the truth. On Bonvalot's map, which is in general rather meagre in point of detail, one can distinctly trace his itinerary from Usun-schor by way of Bagh-tokaj and Amban-aschkan-davan. He gives this last an altitude of 5550 m., which is at least 1000

\* On the map appended to vol. I of the Tibetan Expedition the stream which issues from the lake is also called Tumurlik-su.



m. too high.\* South of this pass he crossed a *rivière gelée* which entered the *Lac qui ne gèle pas*, a very unsuitable name, first given by Przhevalskij, who discovered it; its real name is the Ajagh-kum-köl. But Bonvalot's map conveys no hint of any upper lake from which the »frozen river» could issue.

Carey also travelled by the same route over Usun-schor, Bagh-tokaj, and Amban-aschkan-davan, but instead of continuing on to the south, he turned to the south-east along the northern bank of the »Kum-kul-darja», the breadth of which he estimates at 150 yards: then further along the northern shore of the Kum-köl, to which he assigns no name; after that along its eastern shore, crossing the spring-fed stream from Bulak-baschi; then, still going round the lake, a short distance west; and finally he went on farther towards the south-south-east. His reason for making this long detour was that he found it impossible to get across the Kum-köl-darja. Nor was he able to cross the stream from Bulak-baschi near the lake, but had to go a considerable distance up it, probably to Bulak-baschi itself, before getting over. This piece of country he traversed in the end of May, at which time the ground is already soft; but Bonvalot, travelling in December, had no difficulty in crossing the Kum-köl-darja, for it was then, as he says, a *rivière gelée*. The lower lake into which this stream empties is called the Tschong-kum-köl on Carey's map; and that is far more reasonable than to apply the name, as Roborovskij does, to the upper, smaller lake, for Tschong-kum-köl means the Large Sand Lake, »large» of course by comparison with the other, smaller lake.

Although Carey's map was published four years before Bonvalot's, namely in 1887 as compared with 1891, it is nevertheless far better than its successor. With regard to the Upper Kum-köl, Roborovskij's map is not only no improvement upon Carey's but it actually distorts the lake altogether, first by giving it an utterly erroneous shape, and in the second place by prolonging its eastern end all the way to the meridian of Schapka Monomacha, that is to say three quarters of a degree too far to the east. He says: »The lake of Tschong-kum-köl lies at the southern foot of the lofty range of Kalta-lagan and has a length from east to west of 50 versts and a breadth of 12 versts.\*\* It contains fresh water and is fed by a great number of springs, which exist on its south-eastern shore in the district of Karatschuka. The lake of Tschong-kum-köl discharges by the large stream of Kallautagh, which is joined on its left by the Chal-saj, the Ischak-kaschti, and the Tumenlik; these however only reach it at the high-water period.»\*\*\* According to Carey's map the lake has a length of full 11 km. and a breadth of at the most 3 km. Since now Carey not only travelled beside the lake, but also in part round it, and consequently saw it with his own eyes, which Roborovskij did not, why is it, we ask, that Carey's observations were not incorporated in the Russian map? Carey's observations ought at any rate to be considered more trustworthy than the faulty information that the natives give, especially when that information has to be filtered through an interpreter, who may easily misunderstand what the informant says. On a map that is published on the scale of »20 versts to an inch», one has at least a

\* Carey's estimate is 14,000 feet or 4270 m.

\*\* According to the map its length is 60 versts and its breadth 14.

\*\*\* *Trudij Tibetskoy Ekspeditsij*, III p. 53.

right to expect that it shall at all events make some distinction between data that are certain and data that are doubtful. But on Roborovskij's map of the Upper Kum-köl basin the Upper lake is delineated in the same way as the Lower lake, although the latter was the only one that the draughtsman saw. The same thing is true of the mountain-ranges, even of those that do not exist at all. Any one attempting to reconcile Roborovskij's map with Carey's would have a very difficult task before him; for while the delineation of the former must be taken as certain, the delineation of the latter ought to be taken as almost certain, for the outline of the lake is not dotted. Dr. B. Hassenstein, in sheet IV of my maps in *Peterm. Mitteil.*, Ergänzft. 131, has followed both travellers by entering not only Carey's little »lake» of 1887 but also Roborovskij's Tschong-kum-köl of 1892. But considering that a length of 60 versts and a breadth of 14 versts were improbable in the case of the latter lake, he has reduced its dimensions to 33 km. and 7 km. respectively, and moreover has dotted the entire circuit of the lake, to show that he considers the data uncertain. On the other hand he has entered Carey's lake unchanged, and made a couple of the deltaic arms of the Bulak-baschi enter the lake and the others enter the Kum-köl-darja, which seems to me to be extremely probable, because of the great quantity of mud on the southern shore at the western end of the lake. If the Tschong-kum-köl be taken away from Hassenstein's map altogether, it is then correct, for we return to Carey's standpoint. How far Carey's estimate of 11 km. is correct for the length I am, as I have said, not in a position to determine, but his 3 km. for the breadth is as near as possible right, for at the point where I paddled across it, the lake measured 3200 m. and this, so far as I could see, was the broadest place in it. Carey's omission to enter any streams as entering the lake or the Kum-köl-darja from the south is easily explicable, because he travelled along the northern shore, from which it is difficult to see any of the brooks on the south shore. As for the Lower lake, Carey, while cautiously pricking in its outline on the east, has not ventured to indicate even in any way its westward prolongation: he could not know that Prschevalskij discovered the lake 1<sup>1</sup>/<sub>2</sub> years before. On the whole Carey was in a position to secure trustworthy information, because his companion, Dalgleish, spoke the Jarkent dialect of the Turkish language. But with regard to the nomenclature of the mountain-ranges, he is equally as unfortunate as the Russian travellers. To the Astin-tagh he gives no name at all, but the Akato-tagh he calls the Altun Range. The words »Chimen Tagh Range» are printed across the Kalta-alaghan. The Tschimen valley he names quite correctly the »Chiman Plain», and the little lake which I have simply called »köl» (p. 29 above) Carey calls the Chiman Bashkul, i. e. Tschimen-basch-köl, or the First Lake in Tschimen, which is very probable, even though I did not hear of it. Contrary to Prschevalskij, Bonvalot has correctly indicated that the Astin-tagh is a double range, for which he employs the incorrect Altyn Tagh, a name introduced however by Prschevalskij. The words Astin (or Astun)-tagh mean the Lower Mountains in contrast to Üstün-tagh, the Upper Mountains, though this name is not applied to any special mountain-range. Bonvalot crossed the Upper Astin-tagh range by the pass of Tasch-davan, the altitude of which he gives at 5200 m., whereas its real altitude is only 3960 m.! What are we to think of the remaining altitudes he gives when one that we are able to check is

more than 1000 m. out? He gives the names Guilvet Chiman (= Ilve-tschimen) and Chiman-Tagh to small truncated ranges which it is hardly possible to identify, and the same thing is true of his Chiamang-lay, which ought to be Schia-manglaj. The Kalta-alaghan bears on Bonvalot's map the name of Mts Columbo, following Prschevalskij. Farther south his map bristles with brand-new European names — a very objectionable thing on an Asiatic map. It is for this reason that I have abstained from exercising the discoverer's right of conferring new names upon lakes and mountains. In my former journey I only once departed from this principle. If it is necessary to give a fresh name to a mountain-range, it seems to me that a name such as the Red Sandstone Range or the »Range of the 20th June» is at any rate more instructive than, for example, Chaîne Creveaux. The name of Columbus is used often enough in America without transplanting it to the heart of Asia, where it is quite as strange as the name of Vasco da Gama himself would be. No, let your new christenings be banished to the Poles, where they are necessary, but let the Kalta-alaghan be called the Kalta-alaghan, that and nothing else.

After this digression, let us return to the Upper Kum-köl. We have ascertained that the lake is very small, probably not more than 20 square km. in area. Its mean depth reaches 1.12 m., that is 1.12 m. is the mean of the twenty-six soundings I took, though that is too small a number for a lake of that size, so that the value in question is only approximately correct, and is only true of the eastern half of the lake. I consider it probable, that the western half is even shallower, especially if it is the case that a river enters it there. The annexed sketch-map will show the probable course of the bathymetrical curves.

Briefly put, the hydrographical and morphological arrangement is as follows. Between the Kalta-alaghan and the Arka-tagh system lies an extensive basin. On the west this basin is separated from the basin of the Atschik-köl by an inconsiderable ridge and on the east by a notable swelling from the district of Tschulak-akkan, that is to say the gigantic basin of Tsajdam, which lies more than 1000 m. lower. The deepest part of the basin we are considering forms a long, narrow depression along the southern foot of the Kalta-alaghan. The deepest part of this elongated trench is occupied by the large lake of Ajagh-kum-köl, or the Lower Sand Lake, the water of which is very salt. As compared with this, the Upper lake, which is fresh, is called Basch-kum-köl, also simply Kum-köl, or the Sand Lake, because it is situated in the immediate neighbourhood of the drift-sand area. The spring-water which gathers on the south and enters this lake makes its way by the Kum-köl-darja into the lower lake. From the Arka-tagh and its foothills three or four streams flow northwards towards this elongated depression, and empty themselves either into the lakes or into the river which connects them. The difference of elevation between the two lakes is extremely slight. For a description of the Ajagh-kum-köl and its surroundings I must refer the reader to a later chapter.

The shores of the Kum-köl are frequented by enormous numbers of wild geese and wild duck, which find plenty of sustenance amongst the mud at the bottom and in the Algæ, while the water of the lake contains also Crustaceans of the same species as those which occur in the springs and marshes.

In the afternoon it blew a violent gale from the south-east, and this was followed by exceptionally heavy and long-continued rain.

July 30th. In the morning the lake and its environs were shrouded in a thick damp mist, so that nothing of the Kalta-alaghan was visible, and we were unable to get so much as a glimpse of the northern shore of the lake. Farther south, and later on in the day, the mist did it is true lift, but by that the mountain-range was so far distant that its outlines were only faintly discernible. All that we were able to see distinctly was the immediate vicinity of our route. The atmosphere was still and the mosquitoes pursued us in veritable clouds. It was not until the afternoon was well advanced that the air cleared.

We now left the bottom of the Kum-köl depression, and climbed slowly up towards its southern border-range and water-divide. The rich grass soon came to an end, proving to be only a narrow girdle around the lake, broadest at its eastern end, where the springs are numerous, but gradually narrowing towards the west in proportion as the springs gave out. On the northern shore there would appear to be scarce any grass at all. Immediately south-west of our camp were a couple of small lagoons, separated from the lake-shore by a low sandy ridge. Thence we directed our steps towards the south-south-west, crossing on the way the extremities of the offshoots from the sand, which point westwards like long, narrow fingers, sparsely covered with grass. These outlying dunes do not therefore possess the usual semi-crescentic or conchoidal base; such formations only appear farther east, where the sand is bare. The sandy ridges are to a great extent held together by vegetation, though the grass is so scanty, that at a distance it makes no difference to the usual yellow glare of the sand. Many of these ridges upon coming themselves to an end are continued by smaller insular dunes built up in the form of knolls. The slopes of the dunes were here frequently pretty steep.

In the hollows between these apophyses, or fingers, the hard, but moist, earth produces a richer crop of grass, and in most of them there are one or two small lagoons of fresh water, although with a slightly brackish taste. These lagoons, like the lake, are evidently fed from springs, which gush out underneath the sand. The high dunes, which here generally turn their steep sides towards the south-east, approached quite close to our route on the east; but as we advanced they receded to an increasingly greater distance, whilst at the same time their crests grew both lower and flatter, and finally they died away altogether. Meanwhile the surface became hard and gently undulating, here and there strewn with gravel, but otherwise dotted over with a thin sprinkling of steppe-plants and grass. At some distance to the west were yellow hills, which so far as we were able to judge in the hazy atmosphere likewise consisted of drift-sand, though I would not venture to assert that they were so. It is however quite possible that the large river, which we were now about to cross over, made a breach in the expanse of sand; this is in reality greater than I thought it was.

The river to which I have just alluded has carved for itself a deep, wide bed through the yellow clay and soft soil, and we now descended into it by three distinctly marked terrace-like steps, the last of which was pretty steep. The slopes down to the level ground at the bottom sometimes consist of flat knolls, and sometimes are steep and sharp-cut, especially where the stream presses against them. At that time the water covered but one-tenth of the full breadth, and the flood, which

may have amounted to about 10 cub.m. in the second, was divided into several branches, some large, some small, and glided noiselessly along in its slightly shelving channels. The greatest depth amounted to 0.65 m., and the water was sufficiently clear to enable us to see the bottom. The parts of the bed in which there was no



Fig. 55. CROSSING THE PITELIK-DARJA.

stream were moist, an indication that quite recently the volume had been incomparably greater than it was then. It is said that at times the river is impossible to cross. Even then it was difficult enough to discover a suitable ford, for the bed is full of extremely fine mud, into which our animals sank, and it was only in two or three places that we saw any gravel. The right bank did not form steps, but went up in a single slope. My guides called this stream Pitelik-darja; it is identi-

cal with the river the upper part of which was visited by Carey. Roborovskij gives the same name (e. g. Pitelik-darja) to the river west of this one, a river which he followed for a good portion of its course down to the Kum-köl-darja. It is very probable that he is right, and that my guides were mistaken. Whatever the name of the eastern river, which we now forded, whether the Pitelik-darja, or, as Roborovskij says, the Bulak-baschi, this stream, formed of several others in the way I have described above, is at all events a large river, and evidently drains a large area; moreover, as it swells to a considerable volume after suitable summer weather, it brings down also large quantities of mud. Where we first crossed it, it was running towards the N.  $45^{\circ}$  W. To judge from the north-east course of its western neighbour, I fancy it soon turns towards the north, perhaps towards the north-north-east, and I have reason to think that it falls into the Kum-köl rather than into the Kum-köl-darja; at any rate the vast quantity of mud off the southern shore of the lake seems to point to that conclusion.

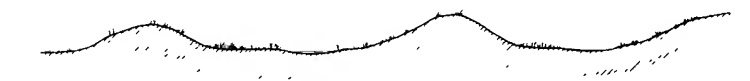


Fig. 56. VERTICAL SECTION OF SAND-RIDGES SOUTH OF KUM-KÖL.



Fig. 57. PITELIK-DARJA; VERTICAL SECTION OF VALLEY.

On the other side of the river the ground was hard and gently undulating. There were indeed a couple of terrace-like steps, but they were too far distant from the river to have any connection with it. I do not however for one moment doubt that the other three steps which I have mentioned on the right of the stream really are fluvial terraces. They show conclusively that the river has deepened its channel 10 or 15 m. within a period that has not been long enough for the older terraces to become in any way destroyed. It is a case of «accelerated» erosive activity, which possibly has some connection with the shrinkage and desiccation of the Tibetan lakes. Every fresh deepening of the estuary must enhance the erosive activity, and this will make itself felt up towards the sources.

The country adjacent to the river is remarkably level. On both sides of our route there was nothing bigger than a few small hills or knolls of no great height; and towards the close of the day's march there was one on our right, and on our left others rather larger, but they were farther away. The all-dominating feature in the east-south-east was a huge snowy crest, possibly the Schapka Monomacha or the Tschulak-akkan, unless indeed both these names apply to one and the same complex. Due south there rose a not inconsiderable mountain-ridge. We next crossed over an eroded watercourse, which did not even show any indication of having been traversed by a flood; it joined the Pitelik-darja. After that the surface sloped away gradually to the left bank of the last-named river. The altitude at Camp No. XVII was 4024 m., pointing to a tolerably gentle ascent southwards from the Kum-köl.

July 31st. After crossing the river once more, we finally turned our backs upon it. Its volume here was very appreciably less than at the first fording; I dare say it oscillated even during the course of the day, a circumstance pointing to the near proximity of its sources. Otherwise the river presented the same features as lower down; its bottom was every bit as treacherous, so that we had to try several places before we dared risk the camels. Here too the right bank was the higher. I was told that the river goes west round the peak which I have designated V, this being the extreme westerly summit of the larger dome-shaped peaks, powdered with snow, which overtop the range we were then approaching at an acute angle. This range, which appeared to be a north-western offshoot of the Arka-tagh, screened entirely the mountainous country from which the river issues, and it was not until we had proceeded a couple of days farther south that I was able to get an insight into the hydrographical relations of the region. Westwards the country appeared to be open, there being no mountains to obstruct the view in that direction. A long way off in the east we saw the continuation of the drift-sand area; it appeared to advance right up to the foot of the range.

Not far south of the river we crossed over another eroded watercourse, containing a small brook; it issues from the nearest parts of the nearest range on the south and soon runs into the Pitelik-darja. The watercourses which we subsequently touched, all dry, run towards the north-north-west and north-west, and they all likewise join the main stream just mentioned. We often travelled along the bottom of these, for we were proceeding south-south-east. We frequently found in them, at one side or the other, peculiar pits, or round excavations with vertical sides, and perfectly dry at bottom; how they were formed is a puzzle to me. The surface consisted of soft soil. The grazing was very good, and there were orongo antelopes everywhere. Besides these we saw a single kulan, hares, *teschikans* — a species of small rodent living in burrows — and lizards.

Immediately east of our line of march ran a chain of hills. We then struck into a rather large eroded watercourse, which seemed likely to bring us up to a pass over the range in front of us. There was no water in it, but a little bit higher up a small spring gushed out of the slope on the left side of the glen, and kept alive a patch of grass, but the rivulet it gave rise to disappeared at once amongst the gravel. There was here any quantity of yak-dung. The altitude above sea-level was 4386 m.

The first hard rock we came to, on the right side of the glen, was granite or pegmatite of a very coarse grain. The same variety appeared also on the left side of the glen. Somewhat higher up there was a granite of moderate-sized grain. By this we had climbed above the misty haze which still hung over the basin of Kum-köl, and were able to see again, clearly and distinctly, the crest of the Kalta-alaghan; the two peaks S and T were easily recognisable.

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## CHAPTER V.

### CROSSING THE ARKA-TAGH.

August 1st. It took us a whole day to get across the next mountain-range, a parallel range of the Arka-tagh system. It was not until we reached the top of some of the secondary passes by which we crossed it that we were able to distinguish the main range of the system. We encamped beside the dry torrent I have spoken of, and in the morning it contained a tiny rivulet, which, originating after rain or the melting of the snow, had by this got down so far. After starting again we passed several similar rivulets issuing from springs, as for instance in the first small side-glen from the south. This we followed until it brought us to a secondary pass. On the other side we descended into a larger side-glen, which likewise joined the main glen; by this last we ascended. My guides had now reached the limit of their topographical knowledge, nor had any of my attendants ever penetrated farther south than this. Consequently we had henceforward to find our way as best we could.

The glen we now essayed likewise led up to a secondary pass, and immediately to the east of it was yet another, the highest we noticed during the course of the day. From this last pass a glen goes down due east, gradually widening as it proceeds, until at the distance of about 4 or 5 kilometers it joins a broad main valley, which gleamed grey against the foot of a mountain-ridge. Whether this main valley is identical with that in which we pitched Camp No. XVIII, or is different from it, I was unable to ascertain. If it is a different valley, then it runs north, gathering torrents from both sides, pierces the chain we were just about to cross, and probably disappears under the drift-sand, giving rise to the springs of Kum-köl. The sand protects the water against evaporation, so that a greater proportion of it reaches the depression than otherwise would do so. On the Kum-köl sheet of the accompanying atlas we ought to have entered this valley as an independent system east of the Pitelik-darja. It would be very interesting to make a thorough exploration of this region as far as Schapka Monomacha and the springs of Tschulak-akkan.

From the same pass another side-glen goes down towards the north-east, it too being no doubt destined to join the main valley. To have followed either of these side-glens would have served no purpose. I was afraid I might lose myself amongst these deceitful foot-hills, as I did in 1896, when I went up and down a great number



Pl. 6.



*Lepus A. B. Lagrelius & Westphal.*

THE ARKA-TAGH, LOOKING SW. FROM CAMP XIX.



of times before I succeeded in getting across the main range of the Arka-tagh. And that experience would have been repeated again had we now turned to the east. If we wanted to get up upon the Tibetan plateau we must turn to the south; accordingly we climbed the slopes on the right of the side-glen that runs east, turning our faces towards the south-east, and crossing a number of small tributary watercourses. From the heights above we commanded a view of the entire glen, winding down to the large valley at the bottom and enclosed all the way down between arms of the mountains, with soft rounded spurs. In this way we approached the crest of the parallel range and its principal pass. This last forms a flattened col or swelling, very little lower than the adjacent peaks.

The view which disclosed itself from the summit of this pass bore a striking resemblance to the orographical arrangement of the great parallel border-ranges of North Tibet — namely a broad east and west latitudinal valley, traversed by a stream, and bordered on the south by a lofty range of gloomy aspect, topped by several dominating snow-capped peaks. Between two of these, due south, there was a gap in the crest of the range, by which it seemed likely that we might cross. Eastwards the country is tolerably level and open, the great valley being broad; towards the west however it contracts, in consequence of several spurs from the range on which we then stood projecting into the valley. The extreme eastern peak in the new range lay to the S.  $64^{\circ}$  E., but was soon hidden from our sight.

The descent into the latitudinal valley was short and not very steep, and was furrowed by several torrents running towards the south-east. As we were travelling towards the south-west, we had to cross some of these torrents and the swelling heights between them. The stream that traverses the latitudinal valley creeps close along the foot of the range which we had just crossed over, and the ground gradually rises from its southern bank up towards the foot of the next range. Its bed contained no running water, only a few small isolated pools here and there. As far as we were able to see, it descended towards the east, but no doubt it turns eventually north and, after uniting with the before-mentioned grey valley, pierces the parallel range we had last crossed over, and so descends to the drift-sand area so often spoken of. It is pretty deeply trenched, but has usually rounded banks, except at the bends, where the concave side is steep. From the top of the left terraced bank I took the bearings of some important orographical and topographical features. To the S.  $48^{\circ}$  E. was quite a small butte, standing in front of the new range to the south; in the S.  $21^{\circ}$  E. a rounded spur jutting out from the butte; in the S.  $3^{\circ}$  E. a lofty peak with an extensive snow-field on its northern flank — in fact the snow formed there three rudimentary hanging glaciers, which sent down the smallest of tongues. Immediately west of this glaciated peak we caught a glimpse of a grey watercourse, with a running stream, which, so far as we were able to see, proceeded towards the north, picking up on its way the brook beside which we were then standing. This then probably constitutes the principal passage for the transverse glen which opens upon the drift-sand area. In the S.  $13^{\circ}$  W. there was a snow-clad mountain-complex. Between S.  $44^{\circ}$  W. and S.  $64^{\circ}$  W. was one unbroken series of snow-clad peaks, belonging to a part of the chain which projects farther to the north, and which then screened from us this greater part of the westward prolon-

gation of the range. It was only far away in the west that we were able to see that prolongation.

Upon leaving the right bank of the principal stream of the valley we ascended with the natural slope, which at first was very gentle; indeed the ground appeared to be quite level, but was nevertheless furrowed by a number of small dry torrents, all directed towards the north-west. The surface consisted of fine, yellow soil, and bore no vegetation except small thin, patches of moss. The only watercourse that contained water was one at Camp No. XIX, about  $1\frac{1}{10}$  cub.m. This issued first from springs, which gave rise to a number of tiny rivulets, that ran together into a single channel, the bottom of which was strewn with gravel. The surface all around was clothed with grass, very short and thick and full of sap, the kind that the wild yak loves to sweep into his mouth with the horn-like processes of his tongue; but for horses and camels it is only poor provender. Here again *argol* (yak-dung) was especially abundant. During the day we saw wild yaks, as well as kulans and antelopes, all either singly or in pairs. All day we found riding difficult, owing to the burrows of a species of earth-rat, and so numerous were they that there was not a single square yard without one or more. In one place we came across the trail of two men with 5 or 6 asses, probably hunters, for it is hardly likely that the gold-prospectors of Bukalik would choose this route.

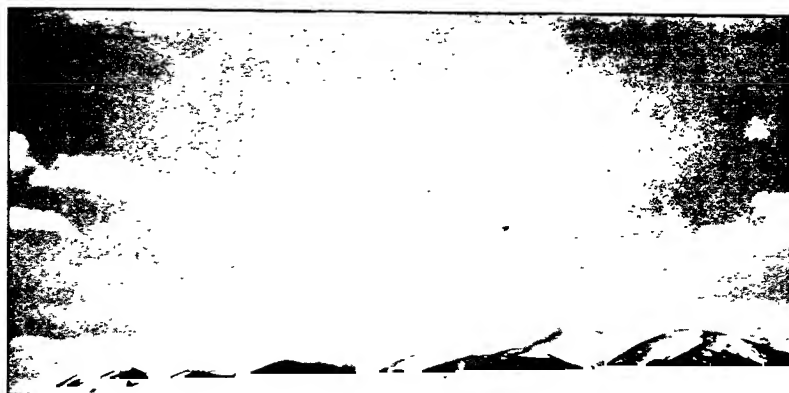


Fig. 58. ONE OF THE ARKA-TAGH RANGES, SEEN FROM CAMP XIX.

In the parallel range which we had just crossed over hard rock was pretty rare, the only places where it cropped out being in the bottoms of the rain-water channels. In fact the range, at all events in this particular part of it, exhibits only soft, rounded outlines. Granite however appeared to predominate, partly of moderate-sized grain, partly coarse-grained like that at Camp No. XVIII. The first little secondary pass cut its way through a variety of fine crystalline rock. All the gravel-and-shingle de-

tritus in the bordering terraces and in the bottoms of the watercourses was composed of these same varieties of rock. At our camp the altitude was 4681 m.; the highest pass that day was 4778 m.

Viewed from Camp No. XIX the latitudinal valley stretches towards the N.  $80^{\circ}$  W.; the bluff that juts out from the southern range was visible in the N.  $85^{\circ}$  W.; while in the other direction the main valley ran to the S.  $82^{\circ}$  E. In the N.  $88^{\circ}$  E., almost due east, rose the great snowy mass which my men called Tschulak-akkan, the same that we saw from the Avras-davan. This may very well be identical with the Schapka Monomacha, the grounds upon which I arrive at this conclusion being these: during the three days' march from the lake we had travelled 37 km. towards the S.  $18.6^{\circ}$  W., 36.3 km. towards the S.  $25.7^{\circ}$  E., and 29.3 km. towards the S.  $25^{\circ}$  E. When, after allowing for the deviations, I prick off these three days' journey on the map that Hassenstein prepared for my former work, I arrive at a point situated pretty nearly due south of the eastern end of Kum-köl and about 80 km. distant from it. From that same point the Schapka Monomacha lies, according to Hassenstein's construction, in the direction N.  $80^{\circ}$  E. and about 45 km. distant. Now this position agrees excellently well with the position I have found above for Tschulak-akkan; whence I infer that the last-named mountain is identical with Prschevskij's »Monk's Cap». Carey travelled both west and north of this mountain, but unfortunately he gives it no name, calling it simply »Snowy Mts. over 18,000 ft». But until further investigations are made on the spot, the name Schapka Monomacha had better remain, though it would be advisable to obtain as soon as possible the true native name. According to Prschevskij's map of his fourth journey this snowy summit forms part of the range which its discoverer called at first the Nameless, but which subsequently received the name of the »Prschevskij Chain». Roborovskij has adopted the same interpretation on his map of his 1890 journey. On the same map we find another peak, Tumenlik-tagh, 44 versts north-west of the Schapka Monomacha; and both of these peaks have of course found their way into Hassenstein's map for my journey and into *Stieler's Hand-atlas*. Both peaks are capped with perpetual snow. Pjevtssoff shows both these peaks on his general map to the »Tibetan Expedition», of which Roborovskij's reconnaissance in the Kum-köl basin formed a part; but strange to say, underneath the name Tumenlik-tagh he adds in parenthesis the name Schapka Monomacha, while to the south-eastern peak of the Prschevskij Chain he gives no name at all. However both interpretations are equally wrong. It is quite true that somewhere in that region there is a Tömürlik-tagh (the Iron Mt.), but there is no snowy peak Tumenlik-tagh whatever in the region where Roborovskij places it. With regard to the Monk's Cap, Prschevskij has located it quite correctly; it does not however belong to the Prschevskij Chain, but lies a good bit to the north of it, as was plain to see from my Camp No. XIX. The great latitudinal valley extended east from that camp, and after making a slight bend appeared to continue on between the Tschulak-akkan (*alias* Schapka Monomacha) and the range that lies to the south of it. The great snowy mass appeared to be surrounded by several east-west chains, and no doubt itself forms the culminating point of a mountain system lying north of the Arka-tagh and parallel to it. On the map of the Southern Frontier Regions of Asiatic Russia, by the

Topographical Department of the Russian General Staff, to which I have already alluded, Major-General Bolscheff has quite rightly accepted Roborovskij's results, excepting however the mysterious Tumenlik-tagh, a name which has somehow got totally astray, for we find it under the guise of Dschinri (Tokta-pärä).<sup>\*</sup> But there is no snowy peak shown to the north-west of Schapka Monomacha.<sup>\*\*</sup>



Fig. 59. AUGUST 3RD. A SHORT REST.

If on Roborovskij's map I prick off the three days' journey from the environs of the Kum-köl in the directions I have indicated above, I cross not only the three problematical streams forming the Bulak-baschi, but also two mountain-ranges, namely Tumenlik-tagh, in which the peak of the same name is supposed to be situated, and the Kuruk-petelik-tagh, as also the crests on the northern flank of a third range, the Su-petelik-tagh. All these three ranges run, according to Roborovskij, west and west-north-west from the Schapka Monomacha. In all this the agreement with the actual state of things is but slight. In point of fact along the stretch of country indicated only one range is crossed over, and that does not start from any knot in the Arka-tagh, for this range lies a long way to the south of it. The fan-like radiation of the mountain-ranges is altogether a mistake; the sole predominant formation is that of parallel systems separated by broad latitudinal valleys. The principal crest of the Prschevalskij Chain however is, both in the Russian maps I have quoted and in the English map of »Tibet and the Surrounding Regions», placed too far north; but in *Stieler's Hand-atlas*, which has followed Hassenstein's redaction of my former field-maps, it occupies its proper position. Pjevtsoff was the first to be told the correct name of the range, but he wrote it Akka-tagh instead of Arka-tagh, a name

<sup>\*</sup> It ought to be Takta-pärä, i. e. the Throne of the Spirits(?)

<sup>\*\*</sup> The map was published in 1899, or seven years after Roborovskij's map.



*Lustr. A. B. Lagardius & Westphal.*

LOOKING N. 80° E. FROM THE PASS OF AUGUST 3, 1900.





T N 8° W



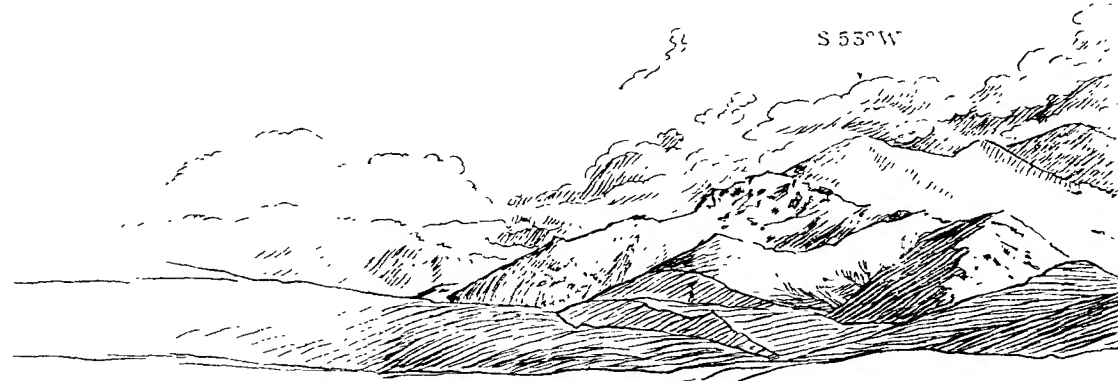
Panorama towards the  
In the background

S 50° E



on Camp XVIII July 31<sup>st</sup>  
alta alaghan

S 55° W



S. H.

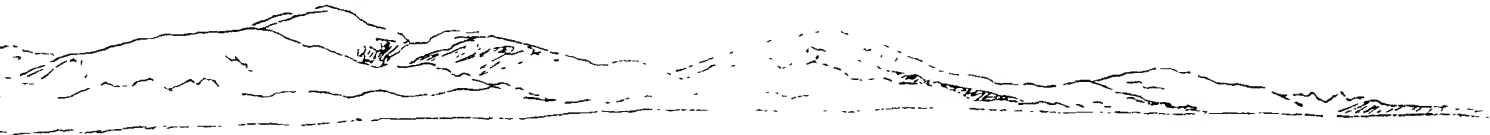
The Arka-tağh or Camp XIX

Snowy summit  
S 1° W



View from Camp XIX

Yemlak-akhan  
N 62° E



Isolated summit



Part of the Arka-tağh





Fig. 60. AUG. 3RD 1900, WAITING SEARCH IS BEING MADE FOR A PASS.

which means the Backbone Mountains or the Farther or Remoter Mountains. The erroneous spelling was due simply and solely to the inability of the Lopliks to pronounce *r*; in place to it they employ a scarcely audible *j* (*i*) sound. Pjevtssoff however, as well as all the other Russian travellers, for reasons that are readily understood, retained the name Prschevalskij Chain and placed the native name within parenthesis. The map of the Russian General Staff has however preferred a sort of arithmetical mean between my Arka and Pjevtssoff's Akka, and prints the word Arkka-tagh, thus showing an unnecessary degree of reverence for Pjevtssoff's double *k*. I am very sorry to have to erase Prschevalskij's honoured name for this great mountain-range, for it would have proved an imperishable memorial of his unwearied and deserving labours; but the name Arka-tagh is the more suitable, more especially as this range really does form the chief backbone of Asia. And the fact that the name is current in the region itself is sufficient to warrant its adoption. Seeing then that there does exist a native name, it would be foolish to give it another, quite as absurd as if a Mohammedan were to come and re-christen the Ural Mountains to Tokta Achun-tagh.

In this new latitudinal valley the peculiar Tibetan weather was more prominently in evidence than hitherto. The first evening there fell a pattering rain, and the next morning, the 2nd August, it was full winter, and the entire country was white with snow. It had been snowing since midnight, and only stopped at 9 a.m. By an optical illusion, the range to the south appeared very much less imposing than

it did on the day before, for its capping of perpetual snow was now lost in the universal whiteness, and no longer noticeable. During the day hail-showers fell at intervals. The following night the thermometer dropped to  $-5.2^{\circ}$  and the water was frozen.



Fig. 61. LOOKING N  $30^{\circ}$  E FROM PASS OF AUG. 3 1900.

August 3rd. A ride of 24 minutes from camp brought us to the top of the first little spur that juts out from the range. This was bordered on both sides by brooks, the bed of the one on the west being the more deeply trenched. Upon emerging into the latitudinal valley this stream turns to the north-west and west; but whether it continues farther in the same direction or whether it wheels round to enter the principal stream that flows down the valley I was unable to ascertain. If the former is the case, we were then quite close to a very flat swelling in the latitudinal valley that acts as a water-divide between the streams on the east and those on the west. If the latter is the case, the little glen must turn to the north or north-east before it can reach the principal stream. The former supposition appears to me to be the more probable.

After that the glen expands and is joined by several other glens. Here there were hundreds of orongo antelopes grazing on the thin jajlaks. One of the side-glens which come down from the south is in its upper part narrow, steep, and choked with gravel and blocks of stone; at its head it is fenced in by a wall of snow-clad mountains. Here it was impossible to advance. Another glen, traversed like

the foregoing by a brook, comes down from the south-west. These two glens are separated by a minor spur, the western face of which is especially steep. The south-western glen ascends very steeply to a pass which was free from snow, but on the other hand choked with gravel. This forms a rather sharply accentuated crest, apparently the culminating crest of this the second of the parallel ranges of the Arka-tagh system. Its absolute altitude was 5005 m. To the south the scene presented was a bewildering chaos of ranges, and snow-capped crests, and dominating peaks. Towards the N.  $70^{\circ}$  W. there opened out a deep ravine with a snowy



Fig. 62. LOOKING N  $70^{\circ}$  W FROM PASS OF AUG. 3RD 1900.

bluff at its head. Due south rose in our path a rather isolated mountain-mass; but this we passed round on the right, after descending the steep southern slope from the pass between the rocky spurs. South-east of the mass I have just mentioned we saw again the same lofty snowy mountain which we had observed at the head of the eastern glen. Brooks run southwards on each side of the isolated mountain-mass. One of these we followed, namely the one running towards the south-south-west; on its way it picks up several smaller tributaries. The brook we were following is shut in on both sides by crests, not very high, of soft gravelly material, through which fantastically shaped pinnacles of rock project here and there. For a long distance this glen runs in almost a straight line towards the south-south-west, but after passing through its last rocky gateway it inclines towards the south-west and widens out, having on its right side several more or less detached bluffs. The

fact of its inclining towards the right is an indication that the next great latitudinal valley, down to which it runs, slopes towards the west. Emerging through its last rocky gateway, we left this glen on the right and made our way down the moist, soft slope, the ground yielding underfoot and being here and there overgrown with moss. From the point where we struck its right bank, we saw the stream that flows down the latitudinal valley stretching away towards the N.  $78^{\circ}$  W. and coming from the S.  $69^{\circ}$  E. To the S.  $62^{\circ}$  E. were three immense snowy domed summits, the highest we had yet seen; they were like three three-cornered hats standing side by side.



Fig. 63. LOOKING S  $75^{\circ}$  E FROM CAMP XX.

Down this new latitudinal valley flowed the largest river we had seen since we left the Tarim. Where we forded it, it was divided into two large and several smaller arms, making in all a breadth of 65 to 70 m.; the mean depth was 25 cm., and at the most not more than 60 cm., often only 10 cm., while the velocity amounted to about 1.50 m. in the second. Thus the volume was about 27 cub.m. in the second, and from the marks on the banks it was evident that the flood is sometimes a great deal bigger. The half-muddy water appeared to issue in great part from the three above-mentioned peaks. This is probably the upper course of the same river which Roborovskij followed in its lower course down to the Kum-köl-darja, and to which he gives the name of the Kuruk-petelik-taghning-su, a very unlikely name by the way, because the term Kuruk (»dry») is about the last name that would be appro-



*Lynch, A. B. Lagardius & Westphal.*

LOOKING NORTH FROM THE PASS OF AUGUST 3.





priate either to the mountain or to the river. The stream flows towards the west, and like the streams in the other great latitudinal valleys, it keeps nearer to the base of the northern mountains than to the base of those on the south. Above the left bank rises a very distinctly marked erosion terrace to the height of 8 to 10 m. The top of this we reached by means of a small side gully. The southern side of the valley is shut in by a stupendous mountain-range, with a gigantic craggy node, crowned by pinnacled summits, sharp crests, and glittering snow-fields, and with several spurs projecting like the side-scenes of a theatre towards the north. At the point where we forded the river the altitude was 4719 m.; consequently we had descended about 300 m. since leaving the pass.

Over gently rising, soft ground, seamed with small gullies and ravines, we made our way south-west towards the opening of a transverse glen, where there was some scanty grass, and a herd of yaks grazing on it. From this side-glen there issued a fairly large brook, which contributed its moiety to the main stream; and from the southern range several similar brooks emerged one after the other. But the range on the north sent down only insignificant contributories. On the northern slopes of the former range there was a greater quantity of snow than on any of those we had hitherto crossed. The precipitation here is greater, and consequently this river is larger than those between the more northerly ranges.

We explored the valley in which we pitched Camp No. XX (alt. 4784 m.); it extended towards the south-south-west, and proved to be quite impracticable, the advance being stopped by impassable snow-fields. On both sides of the valley our camp was overhung by almost completely detached mountain-masses. The illustration shows the one on the east (fig. 63).

Not far from Camp No. XIX there was laminated schist dipping  $62^{\circ}$  S., and projecting in thin laminæ through the weathered materials of the rounded hills. Higher up in the first side-glen of the day red sandstone cropped out, dipping  $14^{\circ}$  towards the S.  $20^{\circ}$  E., and after that black schist dipping  $67^{\circ}$  towards the S.  $60^{\circ}$  W., and hard greenstone. Near the pass there was a variety of hard fine-grained rock, with white veins in it and cleavage-lines running in several directions. This rock dipped  $78^{\circ}$  towards the S.  $20^{\circ}$  E. At the last rocky gateway there was a porphyritic greenstone, dipping  $79^{\circ}$  to the N.  $80^{\circ}$  E. Immediately east-south-east of Camp No. XX I discovered a black schist, alternating with a hard crystalline schist, with a dip of  $80^{\circ}$  towards the S.  $10^{\circ}$  W. Generally speaking, the solid rocks all day towered straight upwards in the form of pinnacles and spires, at the foot of which were accumulated gigantic screes of débris, that is gravel of medium size, but very sharp-edged. We saw granite nowhere. This was the eighth parallel range we had crossed belonging to the middle portion of the Kwen-lun system.

August 5th. In order to get over this the third range of the Arka-tagh, we had to try another transverse glen, and accordingly, after fording the stream that ran north-north-east past our camp, we made a circuit round the mountain-mass on the west, and steered towards the north-west and west, keeping along the northern foot of the mass as well as of several similar spurs projecting towards the north, the slopes of which were overgrown with moss and short, thin grass. The hollows between these spurs are threaded by rivulets, all of which eventually join the main stream of the valley.

At length we reached a larger transverse glen, which promised to lead us up to a pass across the range, and accordingly we turned off south at right angles to the latitudinal valley. From the heights above this glen, before we descended into it, we enjoyed a wide and magnificent view of the latitudinal valley. A gentle murmur reached us from the great river, as it rolled its muddy waters westwards round the small islands of mud and gravel. To the N.  $67^{\circ}$  W. we observed, at a distance of about 10 km., a sort of gateway between the ranges, through which the river continues its course, afterwards probably inclining more towards the north. The range we last crossed, which fences in this great latitudinal valley on the north, is probably pierced at some point by this river, unless the range itself comes entirely to an end and so leaves the river a free passage northwards to the Kum-köl-darja. Roborovskij's map at any rate seems to suggest that this is so. From our point of view however we failed to perceive any breach or gap in the range, which continued in a fairly level, unbroken crest as far west as we were able to see.

Some kilometers to the west there is a massive, mountain-complex of a yellow colour, with snow, whose northern slopes reach all the way down to the left bank of the main river. And south of this complex there is another latitudinal valley, which, with a fall towards the east, turns to the north and in the character of a transverse glen joins the latitudinal valley we had just left. Thus in its lower part it is parallel to the transverse glen we were following; it brings down with it a pretty large brook. In its lowest part our glen brushed past some small buttes; in fact the lowest of these forms the actual left bank of its brook. This was still in part impeded by large sheets of ice, round and under which the water made its way. Our transverse glen came down from the south-south-east and was especially straight; it too carried water. On the left, i. e. the west side, was a low, gentle, rounded ridge or crest, on the right a more distinct ridge, in part covered with snow. From the top of the crest on the left there descended a small brook from the south-west, but the country behind it, on the west and south-west, is shut in by snowy heights. We pitched Camp No. XXI at a bifurcation of the glen, and at an altitude of 4866 m. It rained and hailed heavily all the afternoon.

The rocks in the transverse glen consisted in part of black, soft schist, in part of hard crystalline schist, both dipping  $49^{\circ}$  towards the N.  $5^{\circ}$  E. Solid rock was more seldom within reach, but almost all the crests consisted of bare rock.

August 6th. In the morning the entire country was again buried under snow, but in the bottom of the glen the snow had in great part disappeared before noon. The ground in these regions is everywhere so saturated with moisture that it is vain to look for a patch of dry ground big enough to pitch a tent on.

The glen continued to ascend towards the south-south-east; above our camp the brook carried about 1 cub.m. of water and its channel was gravelly. Another glen that joined our glen at Camp No. XXI was traversed by a rather smaller brook. As we advanced, our brook grew smaller and smaller, for we passed several tiny tributaries on both sides. The glen is bordered by rounded crests. That on the right or eastern side of our glen forms the dividing line between the two glens, which meet at a sharp angle below. At first however it is so low that the snow-clad cliffs which rise on the right side of the eastern glen are visible above it.

Eventually the glen inclines more and more to the south-east. The slope is nowhere steep, being evenly distributed throughout the full length of the glen; all the same in the rarefied atmosphere we felt it very sensibly. The last vegetation to survive up into these Alpine altitudes is moss, growing in small patches; but eventually it also comes to an end, and the ground, consisting entirely of schist débris which rattled and chinked against the horses' hoofs, was then absolutely barren. Hence we were forced to the conclusion, that the herds of antelopes which we saw every now and again were merely travelling from one grazing-ground to another. The precipice on the east side of the glen is here loftier and steeper than that on the opposite side. Finally the glen again assumes its south-south-east direction; the heights around grow relatively lower and assume more the character of flat, rounded knolls. It was evident already that the pass which we were approaching must be one of the first magnitude, and that the crest in which it is situated must be the culminating crest of the range. By this the brook had dwindled to a mere rivulet. In every direction there were patches of snow, though no connected snow-field. During the middle of the day these patches melt rapidly, so that the country everywhere echoed with the sound of bubbling, trickling water. In the last few yards the ascent grew just a shade steeper, and the pass formed a very broad and spacious swelling, covered with loose gravel. There was not a trace of perpetual snow in its vicinity, although it reached an altitude of 5130 m.; from which we may infer that the snow-line in this part of Tibet lies even higher still.

On the other hand we saw due south of us an exceptionally imposing mountain-complex, with fields of perpetual snow, *firn*-expanses, and glacier arms. Between that complex and the parallel range of the Arka-tagh, on the summit of which we then stood, there lies another big latitudinal valley, likewise traversed by a river. The descent from the pass was not very steep, and as usual the southern slope was a good deal shorter than the northern. Down it too a tinkling brook made its way amongst the barren gravel and granite blocks, though these last continue for a short stretch only. After emerging from between the last hills, and uniting with another more easterly brook, the united torrent splits up into a number of arms, which plough their way across an expanse of tough yellow clay and sand, materials that the brooks bring down with them, so that several of these deltaic arms look more like rivulets of thick porridge than water.

Westwards for as far as we were able to see the latitudinal valley was broad and open. The great glaciated mass passed over on the east into dome-shaped, snow-capped mountains. From its *firn* region it sends out three broad, blunted glacier-arms towards the north. These have built up at their extremities gigantic terminal moraines of black debris, forming several rings more or less concentric, and bearing witness to a recession on the part of the glaciers, a fact not to be wondered at, when we call to mind that all the lakes in Tibet are shrinking and drying up. The only solid rocks we perceived were a few solitary crags of a black and brown colour, which stuck up through the white snow as naked needles of ragged outline. The glacier arms glittered intensely white as though snow had recently fallen upon them. From them issued several glacier streams, which joined the principal river of the valley. The whole made a magnificent spectacle, peculiar effects being produced

by the play and contrast of colour, white and blue, of snow and cloud, of shadow and light.

Where the principal river is joined by its tributary there is a broad expanse of alluvium, grey, barren, and very level. From that point we directed our march towards the west-north-west, and made Camp XXII (alt. 4976 m.) in the throat of a small glen on the southern flank of the range that we had last crossed, where the grazing was passably good. In this respect the slopes that face south are the most favourable. Here every glen and hollow had its tinkling rivulet; we had no need to search for water, as we had had to do in the Astin-tagh system.

All day the predominant rock was black schist, partly laminated, partly hard and greenish; in one place there were a number of granite blocks, proving the existence of this rock somewhere higher up.

In making a journey like this through an absolutely unknown region one is constantly tempted to make side-excursions, now in the one direction now in the other, so as to enlarge one's horizon and obtain a general view of the conformation of the country. It would, for instance, have been extremely interesting to follow the big river of the day before both up to its source-regions and down towards its mouth, so as to get a clear and connected idea of the hydrographical and orographical morphology within its drainage area. The temptation was equally strong to stay a while in the vicinity of Camp No. XXII, in order to examine the newly discovered glaciated mass. But I have already explained, that both the time at my disposal and the extent of my equipment did not admit of detailed investigations of this character; moreover it is, I am convinced, a good maxim that the broad features of a new region ought first to be explored and mapped before any attempt is made to deal with it in detail. Besides, this last is much easier of accomplishment, once the general geographical features of the region are understood, and especially does one then know *in what way* one ought to be equipped for making a prolonged stay in such a region as, for instance, the environs of the glaciated mass I am speaking of.

But let me proceed further with the jottings of my journal, and gather together the materials from which to draw our final conclusions.

August 7th. Our route now ran towards the west; on the left we had the principal stream of the latitudinal valley and on the right the range we had last crossed over, its lower slopes, on which we were travelling, being flat, mostly sterile, and slightly sprinkled with gravel. In our advance we forded some rather shallow watercourses, of which five, containing brooks, were not small. The flat gravelly scree does not go down to the principal stream in one unbroken sweep, but terminates at a good distance from it in a kind of terrace or escarpment, below which the surface is almost perfectly horizontal, and it is horizontal too on the opposite side of the stream. This escarpment marks the side of a former eroded channel, dating from the time when the river-bed was higher, and its volume greater, when also the glaciers in the vicinity covered a wider area and yielded up larger volumes of water.

The latitudinal valley extends towards the S.  $83^{\circ}$  W., widening as it proceeds, though at the point where we then were it was not broad. Its fall is towards the



Don Stah, J. J. And

THE GREAT GLACIATED MOUNTAIN - MASS  
south of Camp XXII, Aug 6<sup>th</sup>



west; but from the route we were following I was unable to determine whether the principal stream was destined to enter some self-contained lake on the plateau or whether it belongs to the system that pierces the northern range and feeds the Kum-köl. This present valley bore but little resemblance to the broad, open latitudinal valley south of the Arka-tagh that I traversed in 1896. In this latter no sooner did I pass one lake than another hove in sight; here on the contrary there were no lakes at all. By travelling from north to south as I was doing now I obtained a much clearer conception of the structure of the Arka-tagh than I obtained in 1896. The system turned out to consist, at any rate along this meridian, of an entire series of parallel ranges, and by no means of a single compact chain that sends out ramifications, especially towards the north.

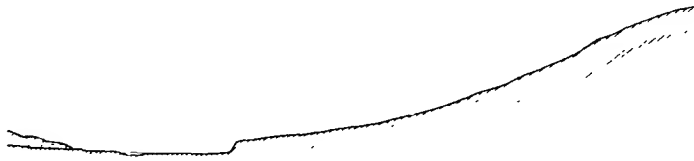


Fig. 64. VERTICAL SECTION OF THE VALLEY.

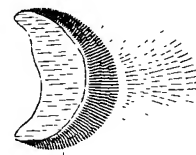


Fig. 65.

The next thing was to cross over the mountain-range which borders the latitudinal valley on the south. To that end we forded the principal river, which did not carry more than one cub.m. in the second, the current flowing along a broad, shallow bed amongst reddish yellow mud; its altitude was 4879 m. So far this stream had flowed towards the west, but upon reaching the base of a large pyramidal dune it turned towards the south-west, and soon became lost to sight. We left it therefore on the right or west, as also a couple of crescentic pools of bright, intensely blue water. These, which had collected at the eastern foot of other crescentic dunes (fig. 65), contrasted in a striking way with the yellow muddy water of the stream. Next we traversed a peculiar crater-like sand-ridge, curving round some small pools. Similar formations were for a space quite common towards the south. The dunes in this new sandy area often stand quite separate one from another. The ground upon which they have been built up is hard and level, sometimes moist and with some gravel. After that we forded a larger brook, with about 3 cub.m. of reddish brown water. Turning off to the south-west, it eventually joins the former one. Higher up in the latitudinal valley this united stream appeared to become lost amongst the dunes, at any rate for short distances; but here, where we were, they again emerged. The latter, the larger stream, was heavily charged with glacial mud; consequently some of the water it contained could not have been filtered through the sand. On its banks, especially its right bank, there are several pretty big dunes, though the dunes of this drift-sand area are very much lower than those of Kum-köl. This area, like that of Kum-köl, occupies only the southern half of the valley. How far it extends up the valley and how far down it I could not ascertain; at all events it continued westwards for as far as we were able to see. On the south it begins on the lowest slopes of the glaciated mass; but the space between the lowest moraine-faces and the first of the dunes is filled with a pretty broad belt of hills and knolls.

and ramifications of the same. The slopes above are furrowed by numerous glacial streams, which cut their way across the belt of sand, for the most part probably underneath the dunes, without in any appreciable way disturbing their position.

Then came a gravelly expanse, barren and level, with smaller dunes, and then another glacier stream, which discharged its reddish brown mud at the place where we were. We made Camp No. XXIII on a slope immediately west of the glaciated mass. The grazing was wretched, little better than hard, dry japkak scrub.



Fig. 66.

All day we had no hard rock in sight. At Camp No. XXIII (alt. 4889 m.) the detritus consisted of granite and a species of black diabase, in blocks that seldom measured as much as 1 cub.foot. As for the bottom of the latitudinal valley, its most conspicuous and noticeable feature is the belt of drift-sand, which stretches, yellow and dreary, around the base of the glaciated mass. With wonderful regularity all these dunes turn their steep leeward sides towards the east. On the northern side of the latitudinal valley there are only rudimentary dunes, and they occur only on the west side of most of the brooks, high up on the slopes above (fig. 66). This again points to the prevalence of a westerly wind, here as throughout the whole of the Tibetan highlands.

The small depressions which contain pools and are inclosed within steep semi-circular ramparts of sand bear indeed some slight resemblance to the bajirs of the Desert of Tschertschen and the desert lakes on the right bank of the lower Tarim. Strictly speaking, they are in fact the same phenomenon, namely troughs between the waves in the sandy ocean, which by chance have become filled with water. But there are also great differences: in the first place, these pools are generally surrounded by separate individual dunes, whereas the lakes of the Desert of Tschertschen are surrounded by accumulations of several individual dunes; again, these pools are fed either by springs which gush up from underneath the sand or directly by brooks which have been arrested by the dunes in their eastward progress, whereas the desert lakes are supplied by small canals issuing from a river. The reason that the water gathers into a pool at the base of these circular dunes, and does not force its way through them, is partly the thickening of the encircling rampart with glacial clay and partly the unbroken continuity of the supply that enters the little pool. The eastward advance of the dunes is in no way hindered by these small sheets of water. But there is a limit to the height to which the surface of such a pool can rise: as soon as the water rises to the level of a permeable layer, it trickles through it, and so resumes its arrested journey, finally emerging as a spring on the windward side of the dune. As the dunes are situated at the west-north-west foot of the glaciated mass and are travelling towards the east, only a very small proportion of the sandy



material would seem to be derived from the morainic debris. The reason why the dunes have accumulated at the foot of the highest mountain-mass in the region is to some extent the obstacle which this mass raises in the path of the regular winds. All the same it is not impossible, that when the glacier streams are more than ordinarily swollen they carry both gravel and sand down to the lowland west of the great mountain-mass, and that this same material, after being duly sifted and sorted, returns towards the source from which it originated in the form of dunes.

The great glaciated mass sends out, as I have already said, several glacier arms, the largest of them towards the north. In this direction the arms are three; but the two eastern ones, which embrace between them a series of black rocky pinacles, soon unite and form an ice-stream, the left (western) marginal moraine of which is of extraordinary size. There were numerous marginal fissures, but we did not see any transverse fissures. The *firn* basin has a favourable shape, in that it forms a couple of huge saucer-like depressions or receptacles for the snow, while on the south it is protected by a lofty craggy ridge. The glacier arms which run down westwards are considerably less; in fact only one of them really deserves this name, the others are rudimentary. But tongues of the ice-mantle or ice-sheet hang down between the glaciers, as they do on the Mus-tagh-ata. All the glacier water runs away west, where it no doubt eventually forms a pretty large stream. In the N. 44° E. we saw the middle one of three dome-topped snowy ranges, which appear to mark the eastward continuation of the range we last crossed over. But no summit within sight was able to compare in point of altitude with the great glaciated mass. This is the last remnant of an ice-sheet which once undoubtedly covered the entire country. It is however vain to seek for other traces of that ice-sheet: there are neither erratic blocks, old moraine ridges (*âsar*) or glacial striations, nor anything of that kind, to be discovered anywhere. Yet this does not disprove the former glaciation, for the great and rapid denudation and disintegration which take place here not only will, but ought to, account for the absence of all such relatively evanescent indications of a general condition which ceased once the climate became drier. The glacial mass that now survives rises therefore like an *insula relicta*, a fragment of an immense ice-sheet, that has now all but entirely disappeared. No doubt it formed for a long period a central node from which ice-streams flowed down towards the west; but of these all that now remains are the fragmentary tongues we saw. These are exceptionally steep, indeed in their lower parts precipitous, and they terminate a few hundred meters above the bottom of the valley, which itself lies at an absolute altitude of 4,880 m. The ice and perpetual snow, which still cover this great mountain-mass, protect it against disintegration, and will in this way preserve it, so that it will long continue to be the culminating summit of the entire region.

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## CHAPTER VI.

### TIBETAN QUAGMIRES — THE GLACIAL MOUNTAIN.

August 8th. Upon starting again we travelled first south-west, beside a spur destitute of snow. The streams we crossed ran towards the north-west, but no doubt they afterwards turn towards the west, to join the principal stream of the valley. Entering the first large transverse glen, we ascended towards the south-south-east and south-east. This is bordered on the west by a big ramifying arm of the range; while to the east we caught occasional glimpses of the gigantic snowy peaks that crown the great glaciated mass. We were now half-way round this great



Fig. 67.

obstacle. The ascent was not steep; even the pass in the new parallel range was easy and convenient, although the altitude was great. I did indeed get a clear conception of the profile of the range at the place where I crossed over it; but what the orographical architecture of the rest of the range is like, it would indeed be difficult to say. For instance I am unable to determine whether the glaciated mass is actually to be regarded as an integral part of this new range or whether it belongs more properly to an independent parallel range, of which it forms the western end. Equally difficult is it to make out, whether this range that we had just crossed is continued farther to the west or whether it tails away and comes to an end about a hundred kilometers farther on in the same direction. It is towards that direction



*Leinstr. A. B. Lagrelius & Westphal.*

THE HIGH PASS OF THE ARKA-TAGH, AUGUST 8.



that the entire country slopes. These questions can only be answered by fresh exploration.

From the summit of the pass, a rounded, flattened saddle at an altitude of 5,122 m., we saw immense snowy mountain-masses in the S.  $75^{\circ}$  E. and S.  $59^{\circ}$  E. The view southwards was again impeded by yet another east-west mountain-range. In the new latitudinal valley at our feet, we perceived a moderate-sized lake stretching from west-south-west to east-north-east. Descending from the pass by a glen that runs towards the south-south-east, we approached the lake by its northern shore.

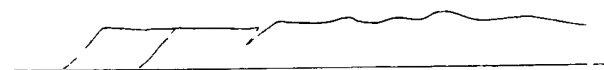


Fig. 68.

The brook that flowed down the glen by which we descended stained a dirty yellow the intense glittering blue water of the lake. At its western end the lake likewise received numerous other brooks, which at their mouths divided into several deltaic arms. The ground there consisted of yellow argillaceous mud, brought down from the northern range; it was soft and marshy to walk on. Close to the southern shore of the lake was a chain, not quite continuous, of table-topped mountains, covered with fresh-fallen snow (fig. 68). The entire neighbourhood was absolutely barren, not a single blade of grass to be seen anywhere. Nor did we all day see any signs of animal life beyond a couple of orongo antelopes. These circumstances rendered even a short stay beside this salt lake impossible. With regard to its outline and appearance I have therefore to rest content with the brief general view which I secured of it from Camp No. XXIV (alt. 5028 m.). This was obtained beside the mouth of a little freshwater stream, which empties into a lagoon-like basin at the extreme western end of the lake, and is separated from it by two pier-like peninsulas of deposited mud. Farther east the lake broadens out, though from the northern shore, where several brooks enter, a blunted peninsula projects (fig. 67), which appeared to be occupied by a small butte, bearing N.  $78^{\circ}$  E. from our camp.

So far as we were able to see for the misty weather, the country in the extreme east appeared to be very open; during the second half of the day rain and hail succeeded one another without intermission, until the ground was sopping wet. It was equally difficult to see how far the lake extended in that direction; it continued at any rate to the horizon.



Fig. 60.

All day the prevailing rock was a soft grey clay-slate; in fact it was so friable that we were able to break it with our fingers, whereupon it crumbled into small thin flakes. It dipped successively as follows:  $38^{\circ}$  towards S.  $40^{\circ}$  W.,  $40^{\circ}$  towards S.  $10^{\circ}$  W.,  $40^{\circ}$  towards S.  $20^{\circ}$  W.,  $58^{\circ}$  towards S.  $25^{\circ}$  W., and  $11^{\circ}$  towards S.  $10^{\circ}$  W., this last being in the pass we last crossed over, and there too there was hard, white quartzite. Generally speaking, the dip of the strata is fairly uniform; but the clay-slate is so soft that an entirely secondary dislocation or folding has taken place all along the edges of the watercourses, and owing to the pressure

of the loose superimposed detritus the clay-slate is everywhere folded outwards. One such place is shown in the accompanying sketch (fig. 69), on the left side of the glen, where the heads of the outcropping strata have been bent into a horizontal position. Other varieties of rock, especially granite and a hard black rock, occur amongst the débris in the watercourses. The vicinity of the glaciated mass will account for the presence of these rocks, which are not visible anywhere else in the locality.

August 9th. The bluff O on the south shore of the lake, visible from our camp to the S.  $55^{\circ}$  E., and itself not at all lofty, is continued westwards in a series of low, softly rounded crests, the southern mountain-border of the latitudinal valley. The task of surmounting these chains was quite easy, for in point of altitude they were but trifling as compared with the numerous ranges that we had already crossed. Nevertheless this region proved to be an extremely difficult one to travel in. Close beside the lake the ground is practically level, and thence it ascends gently towards the foot of the mountains, being furrowed by numerous small brooks that issue from the snow-field on the mountain-mass O. The surface was excessively soft and marshy, and forced us repeatedly to turn back and make detours, for it refused to bear the weight of our horses and camels. The lower parts of the slopes were strewn with chips of dark schist, resting upon an underlying formation of yellow saturated clay ooze. Here the surface was in a measure firm enough to bear us, and the distance up to the summit appeared but short. Yet the higher we ascended the softer grew the ground. There was not a scrap of hard rock to be seen; the slope consisted entirely of rounded ridges and offshoots of the main range, between which the rivulets flowed down towards the north-west. The western water-divide is situated therefore not far from the shore of the lake. We were making our way up on a ridge between two of these brooks. But the surface soon became so soft that our animals dropped in up to the knees. We who were on foot made stepping-stones of the loose flakes of schist scattered over the ground, or rather tried to do so, but they too sank into the yellow ooze, leaving holes full of water where they disappeared. We could hear the water bubbling, gurgling, and trickling along underneath the débris. It was like walking over subterranean rivers and brooks, which every moment threatened to engulf the caravan. In fact, I marvelled that the entire mountain-side did not, through its own sheer weight, spread itself out thin like a quaking viscous porridge. The only time when it would be possible to travel in this region would be in winter, when the flanks of the mountains become frozen. In a few places, where the flakes of schist stood on edge, the ground bore rather better; but in the broad shallow torrents, in which there were occasionally small pools of water, it was utterly impossible to advance; in one such place we nearly lost a couple of horses. Some of the men whom I sent to the top of the range to reconnoitre reported, that this was not the only crest, but that there was a whole series of similar ones farther south, all evidently consisting of the same soft and treacherous formation, and all streaked with patches of snow, which by melting only made the surface still softer and more boggy than before. In a word it was about the most hateful conformation that it would be possible to find anywhere on the earth, and it, even more than the attenuated atmosphere, made havoc with the strength of the caravan animals. One naturally inquires how these mountain quagmires originate. Well, they

are evidently formed out of older deposits of disintegrated matter which is modelled by the advancing erosion. In the spaces between the distinctly marked erosion channels the water flows in very thin broad sheets amongst the detritus, and thus gradually washes away the finer material, leaving the schists on the top, and this superficial layer of schists has no hard rock underneath to support it. If now this detritus material were only dry, it would of course bear, but it is softened incessantly by rain and melting snow, which does not make its escape in the form of determinate brooks, but for the most part penetrates vertically into the ground where it falls. The entire absence of vegetation is another important factor: there is not a single blade of grass within sight, not a single root imparts firmness to the ground: it is all in a state of flux, loose and disconnected. In the sequel we shall find that ground of this type is characteristic of the Tibetan highlands, especially where they are flattest and the erosive energy is least. This boggy, unstable condition of the surface constitutes one of the principal difficulties that a caravan has to contend against in those regions. Some parts of the plateau cannot possibly be explored except in winter. At the point where we turned the altitude was 5,248 m.

On the south-western side of the ridge up which we attempted to ascend there was a shallow rainwater channel, into which such water as does not sink into the ground gradually gathers. The bed of this muddy yellow brook, which swelled eventually to the volume of a couple of cubic meters, was fairly firm, and as we had no other choice, we perforce marched in the water. This led us north-west and west-north-west towards the next self-contained drainage-basin. The ridges on both sides gradually grew relatively lower and flatter, and the country began to open out. On the north we had quite close at hand two small patches of sand with low dunes, which turned their steep face towards the east. Seeing now that dunes demand an arid climate as the condition of their formation, it is indeed strange to find them existing in such a moist region as this. They prove at all events that periods of dryness do occur here at some time or other of the year. Farther to the north rose the range which we had lately crossed over; towards the west it appeared to grow lower. One of the most conspicuous peaks of the great glaciated mass, E, was everywhere visible. To the south an entire series of stupendous peaks stood out in strongly accentuated whites and blues.

The brook gradually gathered strength, and finally ran into two miniature lakes (alt. 5,084 m.), or rather into a large pool with a narrow »waist« in the middle. The upper basin was of a dirty green colour, the lower yellow. One would have expected the opposite, for the brook itself is a muddy yellow. Probably the upper basin is the deeper. The brook flows through them both, for it issues from the lower pool and continues its western course, with a slight inclination towards the south. As it advanced its basin grew increasingly deeper.

The reddish yellow ground on both sides of the brook consisted of soft mire; in one place it formed a small pool of about a score of meters in diameter. Next, from the south-east, there came another brook, considerably larger, and divided into several arms in a broad bed. After the two brooks have united, and have picked up a third brook coming from the north, the channel grows deep and narrow, and the schists crop out on both sides in its inclosing terraces. The volume would be

about 5 cub.m. in the second. On the right bank grew a little grass and japkak. The only signs of wild creatures were a solitary hare and the tracks of antelopes.

During the course of the day's march we saw hard rock in only two or three places. The first was white quartzite, beside the two small lakes; the second hard crystalline schist, dipping  $62^{\circ}$  towards the S.  $60^{\circ}$  W., beside the little pool. This last jutted up out of the soft ground like a slab set on edge, and possibly belonged to a detached block. At Camp No. XXV, where the stream cuts its way through the hills, there was again hard rock. Amongst the debris in the miry hill there occurred fragments of some sort of pumiceous or scoriaceous rock.



Fig. 70. EROSION TERRACE AT CAMP XXV.

This will be a convenient place to say a word or two about the weather that prevailed during the two days we spent in this locality. From 12 to 2 p. m. on the 10th August it hailed, the clouds coming from the west. The storm signalled its approach by the sky turning blue-black in the west, and a few minutes later the tempest burst. After it was over, the sky cleared a little, but at 4 p. m. it once more darkened, announcing the onset of another tempest, and this proved to be more violent than the other. First came a few harbingers of the storm and gusty squalls, and these were followed by a hard, steady blow accompanied by hail, and last of all a copious fall of snow, the wind slackening off a little. Such is the routine. The tempest was heralded by thunder, which crashed so loudly that the earth trembled, and the lightning flashed incessantly, several times in the mi-





*Instr. A. B. Lagvelius & Westphal.*

DETERMINING THE ALTITUDE (5122 M.) OF THE PASS OF AUGUST 8.



nute. The storm-clouds appeared to sweep the very surface of the earth, and we felt how hopeless we were thus defencelessly exposed to their arbitrary power. The first burst of hail made the ground perfectly white within the space of five minutes. The snow fell in thick, medium-sized flakes, but the ground did not get covered to a greater depth than 4 to 5 cm., for no sooner did the snow settle than it began to melt from underneath, and by noon on the following day it had mostly disappeared, except for a few scattered patches in sheltered situations. That day the hail-storm did not make its appearance until 5 p. m.



Fig. 71. CAMP XXV. BEGINNING OF A STORM.

August 12th. The brook at Camp No. XXV (alt. 5,011 m.) continued towards the west-south-west. Whether and how far it afterwards turns towards the west or the north-west we were unable to see, because of the low rounded hills and elevations through which it forces its way before it disappears. Its volume had dwindled a very great deal, and the water was half clear, a sort of dirty green, though previously it had been yellowish brown like a clay puddle. In the morning at the camp the stream had a breadth of 9.15 m., a mean depth of 0.30 m., a maximum depth of 0.37 m., a mean velocity of 0.56 m., and a volume of 1.66 cub.m. in the second. The marks on the banks showed that it had recently been at least as high as 5 or 6 cub.m. At that season it pretty certainly oscillates in this way every day, the causes being the varying amounts of downfall, the bright or clouded condition of the sky, and the frostiness of the nights.

Having forded this stream, we travelled on towards the south-east, having on our left a low ridge of mire and débris similar to that of Camp No. XXIV, and evidently belonging to the same system of hills. On the right, but at a greater distance, was another similar ridge of a red colour. Between the two there was at first a shallow eroded channel, which gathered into itself all the small rivulets and brooks that we crossed over; and at Camp No. XXV it joined itself to the stream there. Thus here the brooks flow towards the north-west, but farther on they run towards the south-west, and then make their way into another principal stream which likewise has hills on its left bank. Possibly it has a more westerly or west-north-westerly course: it appears to originate in a couple of pools.

The country here, when seen from a distance, wore a particularly inviting and attractive appearance, undulating in long sweeping curves scarcely noticeable, and with an insignificant general rise, and no difficult mountains to impede the view, so far as the clouds would permit us to see. And yet the surface was every bit as abominable as on the miry mountain: it was as soft and spongy as a morass, and consisted of fine yellow plastic clay and mud. Owing to the débris on the top, it wore a deceitful appearance of being able to bear, and yet the animals sank in a foot deep. When the conditions are especially favourable they do not go in more than 1 dm., and the footprint becomes a dark gaping hole; but as a general rule the footprints of the animals fill up again with the soft porridge-like mire and two or three minutes later can be no longer distinguished. Nowhere was there a square foot of dry ground; it was all saturated, miry, a veritable slough of despond. Whilst travelling along the latitudinal valley immediately south of the Arka-tagh in 1896 I did indeed come across similar boggy ground, though nothing at all comparable to this that I have just described. Possibly the time of year may have had something to do with it. In 1896 it was the end of August and beginning of September when I was in that part of Tibet. Thus it was not very much later; but then in those regions the summer is short, the frost hardly gets out of the ground before April. Probably some parts of the region are further advanced in disintegration and saturation than other parts, and the downfall varies from year to year, while its amount also may be unequally distributed over the different districts. One thing however is evident, namely that the northern boundary of this hateful country is the Arka-tagh. There are it is true boggy tracts in the basin of the Kum-köl, but they are neither so dangerous nor yet so extensive in area but that they can be avoided without any very great loss of time. The peculiar quagmire region which I have described begins only on the south side of the Arka-tagh, in precisely those regions in which the self-contained drainage-basins form a sort of mosaic, and the levelling and filling up of these basins has advanced so far that the surface is flat, and erosion no longer works with concentrated energy. In the flatter parts of these self-contained basins the fall is so insignificant that the running water no longer possesses any decided power of erosion, but, as I have already said, is sucked up by the ground just where it falls. Among the subsidiary ranges on the north side of the Arka-tagh the erosion is peripheral and more energetic.

As we proceeded south-east, we still continued to be accompanied on the left by the same low miry ridge. Its slopes were furrowed, not however by ordinary rain-

water channels, but by merely slight scorings of the surface. Towards the bottom of each of these hollows there usually gathered a little brook, and even if there were no brook, the bottom was always the softest, and one might easily have been »drowned» in the liquid mud. Between this ridge and a small isolated dome-topped mountain that rose in front of us there was an important water-divide or swelling, which separated us from the next self-contained basin on the south. This too contained a lake in its middle. From the extremely flat swelling (alt. 5,111 m.) a couple of rivulets flow down westwards to the pools I have lately mentioned, and on the opposite side a brook goes down towards the south-east, the ground sloping gently in that direction between low hills. The bed of this brook was rather firmer. We pitched camp at the southern foot of the dome-topped mountain, where a little grass was growing. Camp No. XXVI had an altitude of 5,076 m. We did not see here the slightest signs of either wild-yaks or kulans or antelopes. Evidently they shun these regions, where there is no pasture, and where they would have greater difficulty in escaping from a threatening danger. Yet curiously enough we did see a solitary wolf.

Neither did we that day come across any hard rock; the nearest approach to it was weathered, rotten gypsum in a watercourse. Occasionally the bottom of one of these channels would be black as if with pulverised coal, the last surviving remnants of schists destroyed at some antique period. The intensely brick-red hills are likewise no doubt the last survivals of some fine-grained red sandstone or clay-slate.

Our next step was to descend from the flat divide into the next latitudinal valley. Up to this point we had crossed over ten parallel ranges in Northern Tibet, all running from east to west. Of the present range, the eleventh, all that was left was a mere ruin, little more than a mud-ridge in fact, the schist being visible in only one single watercourse. Apart from that everything is not only weathered to excess, but even the disintegrated material itself, except for a thin crust of schist flakes, is powdered to the smallest possible dimensions, and this matter, when duly mixed with water, makes a wet yellow clay, resembling thin dough or porridge, so soft indeed that footprints in it have no permanence, the material closing up over them like a viscous fluid. But that these characteristics do not apply to the whole of this range, or everywhere along the latitude in which we then were, we ascertained on our return, for farther west on the selfsame latitude we crossed actual hard rocky mountains. But on the meridian by which we were travelling the range between Camps No. XXV and XXVII is quite different from the ten ranges that preceded it. It has, so to speak, advanced a gigantic step farther than the others towards utter decay; it is also flatter and lower, and its glens are neither deeply excavated nor definitely determined. One might almost hesitate to call it a mountain-range at all; it is more like a hilly swelling of the earth's crust.

At Camp No. XXVI it snowed heavily on Aug. 12th, and the whole of the following day it rained violently, the rain alternating with hail showers. The wind blew sometimes from the west, sometimes from the north-east. Icy cold clouds swept across those bleak, impenetrable highlands. Although the thermometer did not drop below — 3°.2, in consequence of the cloudy sky the ground on the morning of the 14th was so far frozen that it bore. In fact it was at first as hard as a

stone; but it soon thawed, for it was of course merely a thin crust that froze. The footprints of the day before in the vicinity of the camp were then filled with small frozen pools.

The direction of our march was dictated by the fall of the brook, and that was towards the south-east. Its bottom was tolerably firm, provided we kept to the water or the margins close beside it. On both sides were low hills, off which numerous brooks and rivulets gathered and entered the main river, which steadily inclined more and more towards the east. After picking up a large tributary from the north, the main river, then swollen to a stream of considerable dimensions, pierces the hills in a narrow gorge, through which we were unable to march; and finally it empties itself into the large lake in the next latitudinal valley. Being unable to proceed, we turned to the right, and ascended beside a smaller stream, that brought us to a *col* or low saddle (alt. 5,106 m.) in the ridge which had hitherto accompanied us on that side. Thence we obtained a grand panoramic view of the new latitudinal valley, which again is bordered on the south by yet another parallel range, crowned in the south-west by an imposing snowy, glaciated mountain-mass. Between the points S.  $75^{\circ}$  E. and S.  $20^{\circ}$  E. extended a large lake, and beyond it, in the S.  $67^{\circ}$  E., appeared yet another mass covered with snow-fields and glaciers, belonging presumably to the same range as the mountain-mass I have just mentioned. The new latitudinal valley is broad, and its bottom far leveller than the preceding similar valley. Seen from the west, its surface slopes slowly towards the lake, and down the middle of it runs a broad channel, with a stream divided into several arms. We saw no grazing anywhere beside the lake, though there was grass in the south-west beside the river.

The southern slope going down from the little col is very steep, and continued so until we reached a brook that flows towards the south-south-west, picking up several tributaries from both sides as it proceeds. Here sparse blades of grass began to make their appearance in places, generally on the slopes exposed to the south; but the only traces of animals we saw were those of antelopes. After a while we left the stream, which thereupon inclines towards the south-east and east-south-east, soon emerging from amongst the hills, where it forms a small lake, and then, flowing in several deltaic arms across the inundated alluvial flats, it empties itself into the lake, without, so far as we could see, first uniting with the principal stream in the valley. From that point we perceived the western end of the lake to the S.  $37^{\circ}$  E. In shape the lake appeared to be oval, and as usual was elongated from east to west, but its eastern end was too far off to be visible. On both north and south the mountain slopes approach tolerably close to the lake.

Keeping to the bottom of the slope, we then proceeded towards the south-west, and approached the left bank of the river at an acute angle. Towards its mouth there appeared to be marshes and swampy ground on both banks, which we could only avoid by travelling as we did. We crossed several brooks coming down from the range on the north, some of which were not altogether insignificant; all these joined the principal river. The terraced bank on the left of this stream was high and steep. The volume may have been some 8 to 10 cub.m. in the second, and was divided into half a dozen large and a number of small arms. Its bottom

consisted of sand, gravel, and mud and was for the most part firm enough to bear us, and such small marshy spots as there were we were easily able to go round. As a general rule the prospect of finding ground firm enough to bear is greater on the slopes facing south than on those to the north, where vegetation is wanting and the moisture is retained longer.

Over a small area on the right bank the grazing, considering the circumstances, was good. Here there were orongo antelopes, but no traces whatever of wild yaks or kulans.

North of the little col is a fairly fine dark-grey crystalline schist, dipping  $41^{\circ}$  towards the N.  $50^{\circ}$  E. On the col itself the same rock dips  $55^{\circ}$  towards the N.  $35^{\circ}$  E., and south of it  $65^{\circ}$  towards the N.  $55^{\circ}$  E. These angles of dip are however not quite certain. But, generally speaking, bare rock is very rare, as on the north side of the range the mountains consist entirely of soft disintegrated materials. There is however gravelly debris in the beds of the streams on the south side of the valley. On the basis of our experience in crossing over these successive parallel ranges of north-eastern Tibet, it may be laid down as a general rule, that hard, bare rock grows continuously less in quantity from north to south. In the Astin-tagh wild, jagged pinnacles and craggy summits predominate; in the Tschimen-tagh softer outlines are more frequent; in the parallel range that we last crossed hard rock was a rarity. On the wide plains of the Tibetan plateau it would be possible to travel for two or even three days without ever once seeing hard rock. It is of course the climate which here plays such an influential rôle. In the Astin-tagh the extremes between the winter and summer temperatures may be more accentuated, but the precipitation is a good deal less. On the highlands there is on the contrary an abundant precipitation and the frost is there probably the most powerful active agent in splitting and breaking down the solid rock. There is a great difference between the day and night temperatures; but within the course of even a few hours, nay often of a few minutes, variations of temperature may occur as great as  $10^{\circ}$  or more. On the 15th August, after the frosty night, the temperature rose to  $+15^{\circ}$ . During the day the insolation is great, and the mountain-sides become warm and dry. Beginning at 10 p. m. it rained heavily for a couple of hours, and everything was wet again; the rain penetrates into the narrow crevices of the rock, and then when it freezes during the night the crevices become enlarged and widened, until finally the material refuses any longer to hold together, but breaks, and is washed away by the next shower that comes, which at the same time exposes another layer of the underlying formation to a repetition of the same process. These same agencies are actively at work in all parts of the world where there exist mountains, but here in Tibet the rate of destruction appears to be more rapid than elsewhere, owing to the active agents being more intense and more energetic.

From Camp No. XXVII (alt. 4,919 m.) we saw in the S.  $36^{\circ}$  W. the culminating summit of the glaciated mass, sending down towards the north-north-east a very broad and short glacier arm, with a number of dirty marginal fissures, especially in the front.

August 17th. Almost due south from Camp No. XXVII we saw in the next parallel range a slight indentation, and beyond it there were no mountain tops vi-

sible, so that there was promise here of an easy pass. Accordingly we crossed diagonally over the latitudinal valley. The surface is level and excellent for marching, being partly grassy, and consequently hard, though elsewhere it is barren and soft, but we were able to go round the places that were too soft. After a while we forded a stream which came from the glaciated mass in the south-west; its volume was then 7 to 8 cub. m. in the second, divided amongst several arms. It was exceedingly muddy, due to the fine frictional matter which it brought down from the glaciers. Its right bank consisted of a terrace 2 m. high. This stream unites

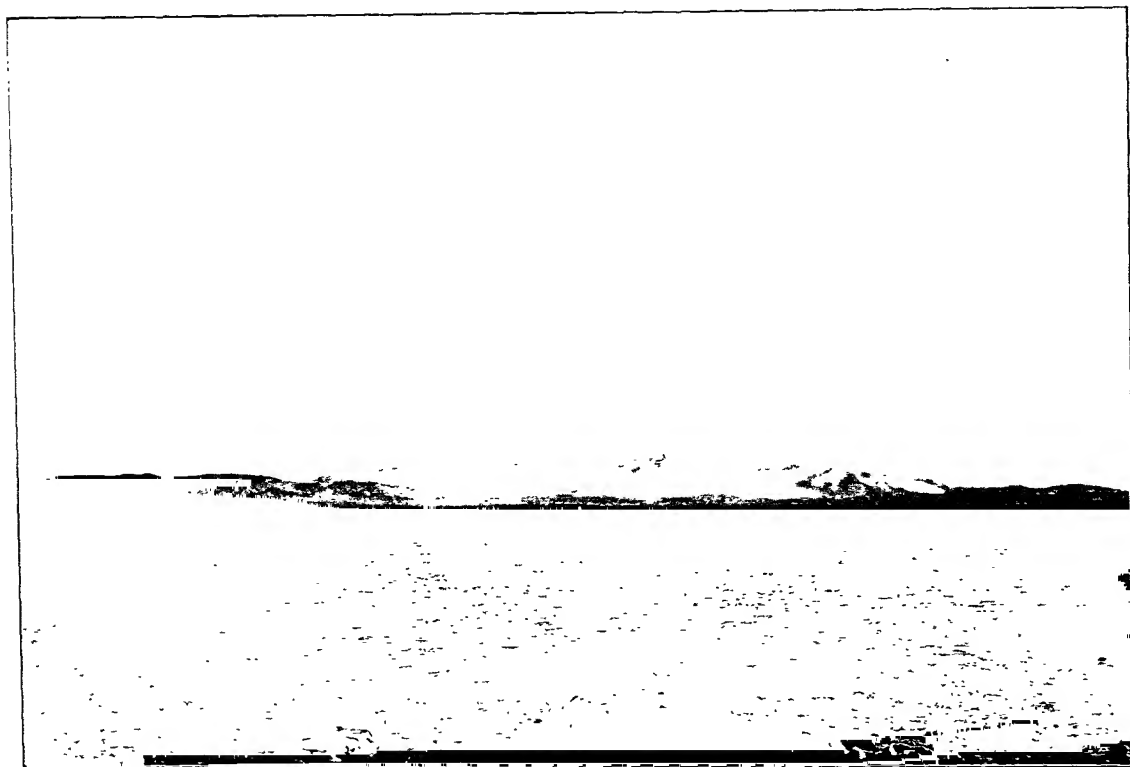


Fig. 72. TO THE S 45° W FROM CAMP. XXVII.

with the one beside which we encamped, and then enters the extreme western end of the lake. Then we ascended by a smaller rainwater channel to a pass close by, but in every respect a pass of a secondary character. Down its southern face flow two brooks, one towards the north-west, the other towards the north-east, and both eventually enter the main stream. Here the surface is again marshy and wearisome. Our route now ran south through a very undulating country, with streams flowing towards the north-west, between steep rounded spurs sloping in the same direction. For a short distance however we travelled towards the south-east through a pretty deep glen, which rose rapidly, and gradually inclined to the east, to a secondary pass, down the other side of which a brook descended to the lake. South of this pass rises a small, but dominating summit, from which one sees to the east a chaos of mountain chains and spurs, with yet another small lake.



After crossing over two other secondary passes, the higher of which reached an altitude of 5,122 m., we at length reached a broader, opener valley, the stream of which likewise flows towards the north-west, into the latitudinal valley out of which we had just climbed. Thus we had crossed these three passes unnecessarily; for had we gone immediately east of the glaciated mass after leaving Camp No. XXVII, we might easily have avoided them; but then the country there had in the distance appeared to be far more difficult. The acclivities of all three passes, especially those on the south, are pretty steep; those on the north are awkward, soft, and marshy. The ground is covered with gravel, with a thin sprinkling of moss at intervals.

East of our route rose side by side a dome-shaped and a flat-topped mountain, both visible also from Camp No. XXVIII. The top of the latter was as level as if it had been ruled with a ruler. The upper part of both mountains is black, and probably consists of the same porous tuff which lies scattered in enormous quantities over the face of the country. On the right the great outstanding feature was still the majestic glaciated mass, with its immense *firn* basin, and black craggy pinnacles towering above it or behind its snow-field.



Fig. 73.

We next followed a gently rising glen towards the south-west, having on the left, on the nearer side of the dome-shaped and flat-topped mountains, rounded red hills and on the right ramifications and offshoots of the great glaciated mass. Thence we attained without any difficulty the principal pass of the new parallel range, a flat and level col, with two small tarns on the top, from which brooks issue and flow away north and south. Following the latter, we travelled south-south-east. Along its margins there were occasional patches of grass; and orongo antelopes were by no means rare. On both sides we had brick-red hills; but the glen shortly contracted to a veritable ravine, in which there is red sandstone in an unblemished condition. At the point where this is pierced by the stream small cataracts are formed. The gorge is so narrow that we were forced to ride in the bed of the stream, which had then a volume of not more than  $\frac{1}{5}$  cub.m. in the second; and for a short distance we were even obliged to make a detour over the hills on the right. Afterwards however the gorge widens out again a good deal, its bottom being full of red gravel. Finally it enters a larger glen, coming from the west-north-west and is traversed by a stream that is divided into several arms and carries a volume of about 10 cub.m., the water being extremely thick and muddy and of a reddish brown colour. It issued from a large glacier arm descending on that side of the mountain, and was heavily charged with glacial mud. After the two or three days of unusually bright, sunny weather, the volume of the stream was no doubt much larger than it usually is.

At the point where the two glens unite, we discovered on the right bank of the stream, at Camp No. XXVIII (alt. 5,024 m.), a certain amount of pasture. Strange to say however, we were not the first people to visit that wilderness; for here we stumbled upon a linen shirt and a couple of rope-ends, which my men recognized as being of Mohammedan make, as also a wooden pin such as the Mongols use to make loops round when loading up caravan animals. At first I was disposed to think that I had struck Wellby and Malcolm's route of 1896; but it is

more likely that the objects I have mentioned were left behind by some caravan of Mongol pilgrims bound for Lhasa. Which route they took it was not possible to ascertain, for we never came across any further evidences of their presence.

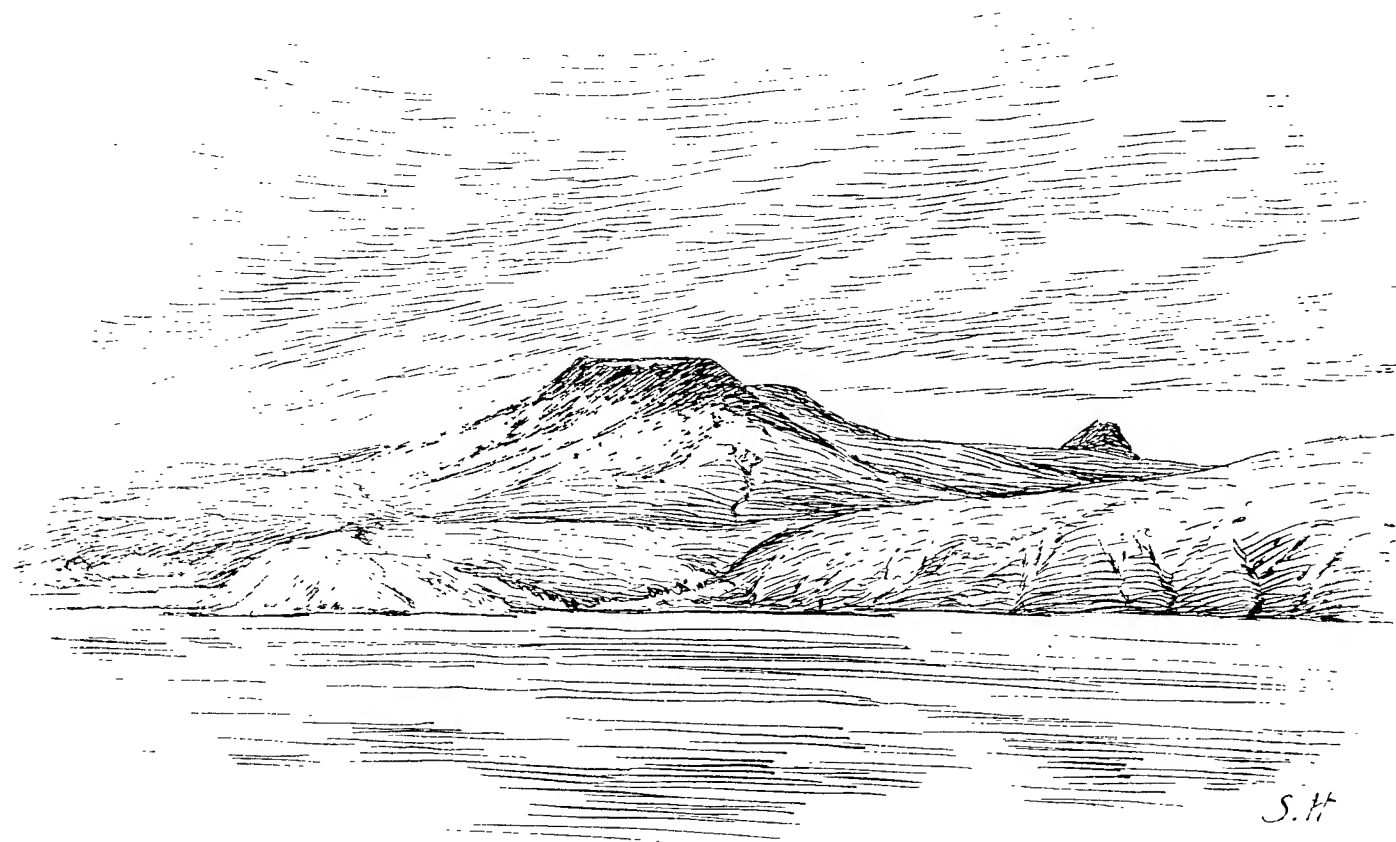


Fig. 74. VIEW TO THE SE FROM CAMP. XXVIII.

As for the rocks we met with that day, in the first hills south of Camp No. XXVII it was black clay-slate, fracturing into thin laminæ, and dipping  $62^\circ$  towards the S.  $35^\circ$  W. At the first pass the rocks consist in part of the same species, dipping  $62^\circ$  to the N.  $35^\circ$  E. and in part of hard crystalline schists. On its southern acclivity were loose fragments of a variety of hard, white rock, which appeared to have belonged to some hidden vein of pegmatite. On the northern face of the second pass there was a hard crystalline schist, dipping  $65^\circ$  towards the S.  $40^\circ$  W., and north of the principal pass conglomerate cropped out in one spot, but in one spot only, namely at the edge of an eroded terrace. South of the same principal pass we had red sandstone, as also loose fragments of a variety of conglomerate. Close to Camp No. XXVIII there occurred a soft species of rock, presumably talcose. At the north-west base of the hill on which our tents were pitched the red sandstone was exposed in steep bare ledges, exhibiting very distinctly a dip of  $34^\circ$  towards the N.  $50^\circ$  E. This seemed to be the prevailing dip of the entire neighbourhood. All the hills round about are coloured brick-red with the disintegrated débris of this sandstone.

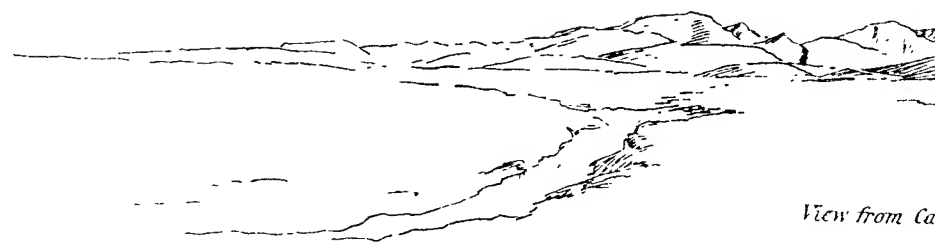
From the great glaciated mass, west of our camp, two huge ice-streams proceed towards the south-south-east; these we saw from the camp in profile,





Scenery W. looking N 20° E from Camp XXVIII

R, S 5° E



View from Camp XXVIII Sept 24



View of the Glacier mountain from Camp XXVIII Sept 24

S.H.

View from Camp XXVIII south of Camp XXVIII



and their left sides, which faced our way, were heavily charged with morainic gravel and full of marginal fissures. Nevertheless there were a couple of smaller hanging glaciers wedged in between them: so that this mountain appears to possess, at any rate in part, an ice canopy of the same kind as that of the Mus-tagh-ata. As it rained and hailed a good deal during the 18th August, we had an opportunity to observe directly the active renewal which took place on and around the great glaciated mass. Whilst it was raining in the immediate vicinity of our camp, it was snowing simultaneously on the mountain, and during that one day alone its firn basin must have received a very appreciable augmentation. The front of the nearest glacier-arm, which approached quite close to us, may have been only some 50 m. above the camp. On bright and sunny days it must melt to such an extent that the glacier stream must have a considerable volume all summer through. On cloudy days it is of course smaller: but then, on the other hand, as on the occasion of our visit, it often rains or snows, so that the stream swells to such an extent as to be anything but easy to ford, even so high up as we were. On the 18th August it received such considerable additions from every direction that it rolled down the glen in one solid flood, emitting a hollow rumble as it hurried past. The rain and hail clouds came from the south. It makes a curious impression upon you when you witness one of these violent hail-storms sweeping across the face of the country. You hear in the south the trickle as of a waterfall; the sound approaches nearer and nearer, increasing in strength, while the ground becomes whitened over directly underneath the oncoming clouds, just as though it were being painted with a gigantic brush. In the next moment the tempest bursts over the camp with a noisy pattering, and the hailstones pelt down with such force that you become extremely careful how you expose your hands and face to them. All the mountains of the vicinity become swallowed up in the impenetrable mist, and it is only through chance breaks in the clouds that you see in glimpses how they are literally pouring out their contents with prodigious generosity over the firn basins of the great glaciated mass.

This atmospheric moisture can scarce have any other origin but the Indian Ocean, and is brought by south-westerly and westerly winds. The clouds no doubt discharge the greater part of their contents on the southern slopes of the Himalayas, but the moist higher strata of the atmosphere sail tolerably unimpeded above the summits of that great protective bulwark, and subsequently divide and distribute themselves over the Tibetan plateau in such a way that the moisture diminishes progressively towards the north. As a general rule it may be said, that it is the central, and at the same time highest, parts of the country which receive the minimum amount of rainfall; while the maximum quantity falls in its peripheral regions, where so many mighty rivers, to wit the Hwang-ho, Irawadi, Brahmaputra, Indus, and even in part the Tarim, have their origins. The rainfall which descends upon the central uplands of the plateau, which are divided into an immense number of self-contained drainage-basins, is therefore so much deducted from the masses of water that reach the oceans by means of these rivers. We have already seen, that where it falls as rain, it penetrates straight down into the ground and disappears, or — but that is exceptional — reappears in the form of springs, while in part it runs

off in channels which as a rule are but slightly eroded and practically always terminate in a salt lake. The crests and peaks upon which the precipitation rests in the form of perpetual snow are far rarer on the plateau than is generally believed. In the course of the journey which I have thus far described we have passed but few glaciated mountains and they all rise above the plateau in the form of insular, round flattened domes, while their relative altitudes are not great. These mountain masses are scattered sporadically over the highlands without any connection one with another, but all the same they always constitute the culminating parts of the parallel ranges, and if only we knew them all, and were able to prick their positions on a map, they would form more or less parallel chains of glacial »islands« of the kind I have described. Seeing now that, as happened during the summer of 1900, at all events during the latter part of August, rain falls nearly every day, and often in vast quantities, one is at first amazed at not finding more extensive areas of perpetual snow, and a greater number of glaciated regions, than actually is the case. But then it happens that the summer is just the rainy season, and during the rest of the year little or no snow falls, as we shall find later on. When I have concluded this physical-geographical and morphological account of the important parts of Tibet through which I travelled during this journey, I shall, in a special chapter, return and deal at greater length with this interesting problem, although the data at disposal are unfortunately not sufficient to permit of definitive conclusions.

On August 19th the glacier stream showed us the way down to lower regions, where there was reasonable hope of finding better grazing. The stream had however shrunk considerably: the water, thick with clay, flowed along silently like oil, and yet the velocity was not less than 1.6 cub.m. in the second. At 9 a. m. the water had a temperature of  $6.3^{\circ}$ . We forded the stream just below the camp, at a point where it is joined by another stream, equally as big as itself and of the same brick-red colour. The latter issues from the western frontal part of the great glacier arm situated in the S.  $80^{\circ}$  W. At first we marched down the middle of the channel; the ground there, although wet and muddy, was mingled with gravel, and was hard, the loose material having been packed together firmly by the running water. But after fording the river a certain number of times, we kept for a while to the hills on the left bank. At the last fording the whole of the volume was collected into one channel 28 m. broad. The hills were very low, rounded, and grass-grown; but the brick-red colour predominates everywhere. Here there were a couple of small pools. Opposite to us on the right bank was a small isolated mountain, which plunged steeply down into the bed of the stream and appeared to possess relatively good grazing in its smaller hollows. Here again our stream was joined by another coming from the west, this too as big as itself. The dimensions of our stream were gradually increasing, and when we finally lost sight of it, it was so large that it could not have been forded without difficulty. As a rule it is divided into several arms. At that time only a small portion of the channel was covered with water; but it was nevertheless everywhere wet, showing that quite recently, probably after the last continuous rain, the volume had been very considerable indeed. One branch of the stream flows close in under the isolated mountain I have just spoken of, and there the red sandstone is again exposed in the face of the deeply scarped bank.

Although the country is dotted over with a number of peaks, generally standing isolated, it is nevertheless on the whole open, our view being obstructed by nothing except clouds and rain. Seen from the south, the dome-shaped and flat-topped twins (X and W) present the shape and appearance shown in the accompanying sketch (fig. 75). The mountain A consists of two summits, one of which, when seen from a certain position, looks like a Monte Somma wound round the dome of the other, though when seen from another point of view it disappears completely. A resembles a hog's back or dolphin's back; while Y and Z are tolerably regular cones. All these summits appear to lie along one line, running parallel to our route. Probably they represent the surviving relics of a former spur of the main range, which except for them has now been entirely destroyed.



Fig. 75. SUMMITS X AND W.



Fig. 76. SUMMITS W AND X.

Once more the great glaciated mass stood out in all its stupendous majesty, and a fresh glacier arm became visible to the west of the arm we have lately had in view. This makes the fifth great ice-stream that we saw issuing from the central *firn* area. This great mountain-mass is continued towards the south-south-east by black mountains of a massive character, the peak O, with some snow on its top, being the highest. In the S.  $78^{\circ}$  W. we saw an imposing snowy peak towering up above and beyond the glaciated mass, though it probably belongs to the same main range as the latter. Then yet another glacier stream made its appearance proceeding from the glaciers farther west. Although we thus got only fugitive glimpses of the main features of the geography of this mountainous country, we saw sufficient to suggest, that the abundance of thaw-water and rain-water which flows towards the south must eventually combine to form a large river, and it is pretty evident that this river can only terminate somewhere in a large lake. The glacial and hydrographical agencies which we now see so active are however but transient, being restricted to the few brief summer months. It may pretty safely be assumed, that the movements of the glaciers, which even during the summer are slow, cease entirely, or nearly so, during the winter, while the paltry rivulets which are at that season found in the watercourses become converted into ice.

On the left bank of our glacier stream the surface was sometimes undulating, sometimes almost level, and there we crossed over a whole series of small brooks, the ground in the vicinity of which was often soft and treacherous. The hills on the right bank grew increasingly flatter, and began to spread out more and more, and descend into the latitudinal valley as we approached its deepest parts. The stream continued on towards the south; but leaving it on our right we turned away



towards the south-east, and eventually the river became hidden from our sight by an isolated group of hills. Between this and the chain of larger hills which we then had on our left there gradually appeared a flat glen with a brook flowing down it, divided into several arms. It was no easy task to get across it, for its bottom, which was strewn with fine, white gravel, resting upon the treacherous wet, yellow clay, was exceptionally marshy. We pitched Camp No. XXIX on its right bank at an altitude of 4,907 m.

Hard rock still continued to be very rare. It was only in the steep escarpment of the stream that the red sandstone cropped out, and its dip was the same as at the preceding camp. At the point where we left the stream the green crystalline schist shows, but only just shows, above the surface; it dips  $54^{\circ}$  S. and is excessively weathered, while its exterior is blackened and glazed, and coated as it were with bark. We again saw the same phenomenon in a few other places later on, though fragments of this rock are common everywhere.

We saw here orongo antelopes and wolves, and traces of bears and kulans, these last quite numerous; while close to the glaciated mass the tracks of wild yaks were very abundant. The dung (argol) of the last-named is the only fuel to be obtained in these regions, unless by rare good fortune one stumbles across some of the hard scrubby plants of the *japkak* or *jer-baghri*.

The downfall still continued copious, though the wind now blew from the north-west, whereas the day before it was the south wind which brought the clouds and the rain. Thus the direction of the wind appears to be of minor importance; but then it may be subject to local deviations. During the afternoon the rain was extraordinarily heavy as well as violent, and was accompanied by thunder and lightning. In these high altitudes the thunder crashes with a deafening noise. It is not the usual hollow rumble that we are accustomed to hear, but is more like the clanking of gigantic iron plates being hurled one against the other. The collision involuntarily awakens a feeling of disquietude in the mind. We seldom or never heard the thunder during the night. The greater part of the rain used also to fall during the day, although on this occasion it rained on without a break from 8 p. m. to 6 a. m. the next morning. Frequently clouds of an exceptionally dark and threatening character would drive across the earth without discharging any of their contents. On such occasions it would at noon sometimes be as dark as it ordinarily is just after sunset.

Pl. 12.



*Lynstr. A. B. Lagrelius & Westphal.*

THE GREAT SALT LAKE, LOOKING SOUTH FROM CAMP XXX.



## CHAPTER VII.

### A TIBETAN SALT LAKE.

August 20th. The stream beside which we encamped flowed towards the south-south-west, and soon afterwards joined the large river of the day before. Instead of following it, we steered our course towards the south-east, across the low, flat rounded hills. These consisted entirely of soft material, and they were threaded by small brooks and rivulets; while in other places the ground was wet, and consequently very marshy. Our track meandered up and down, but the differences in elevation were really very slight. At a distance of 3 to 4 km. to the west we saw the river winding like a dirty red ribbon through its broad mud-filled bed, the country through which it flows being uncommonly level. Southwards too the country appeared to be remarkably level, and easy to march across. Almost all day the grazing was tolerably good, consisting chiefly of moss and wild garlic; in some parts of the Tibetan highlands this last is extraordinarily abundant. At a little distance to the left of our route was a series of hills of moderate elevation, while to the east-north-east rose a dome-shaped mountain (B<sup>1</sup>) free from snow. Except this and the peaks we had lately turned our backs upon, there were no other dominating summits visible. Between the chain of hills and our line of march the country formed an almost dead level, its undulations being hardly perceptible. There were a good many wild yaks busy grazing. On both sides of us there were numerous small pools, into which the rivulets of the neighbourhood flowed.

After that we made a detour half round two small lakes connected together by a sound 2 m. broad, the shallowest part of which had however a depth of  $1\frac{1}{3}$  m. Its bottom was hard and firm enough to travel on. The water in the upper lake is fresh and of a yellowish red colour, and consequently must somewhere be entered by turbid brooks, while the water in the lower lake is salt, but bright, and of an ultramarine colour. The water was flowing out of the northern lake into the southern, although the current was scarce perceptible. The western shore of the lower lake is studded with pools, both big and little. Both lakes are surrounded by low hills, with sandy ground, and the best grass we had yet seen since leaving the Kum-köl. At intervals the lower lake is joined by ravines, then however without water, although the bottom was covered with moist sand and gravel which would hardly bear us.

Our route was now towards the east, up a gently ascending slope. On our left we passed a couple of big pools with brownish-grey muddy water and on the right a large lake, considerably bigger than the two just mentioned. It is long and narrow, and extends towards the west-south-west. After climbing over a flat saddle, we saw in front of us to the south-east a very large lake, the eastern shore of which was not visible, though in the far distance we saw low mountains. The sandy hills sink gradually down towards its shore. I generally observed in this region that, wherever there was grass, the ground was always sandy: possibly that is because the sand allows

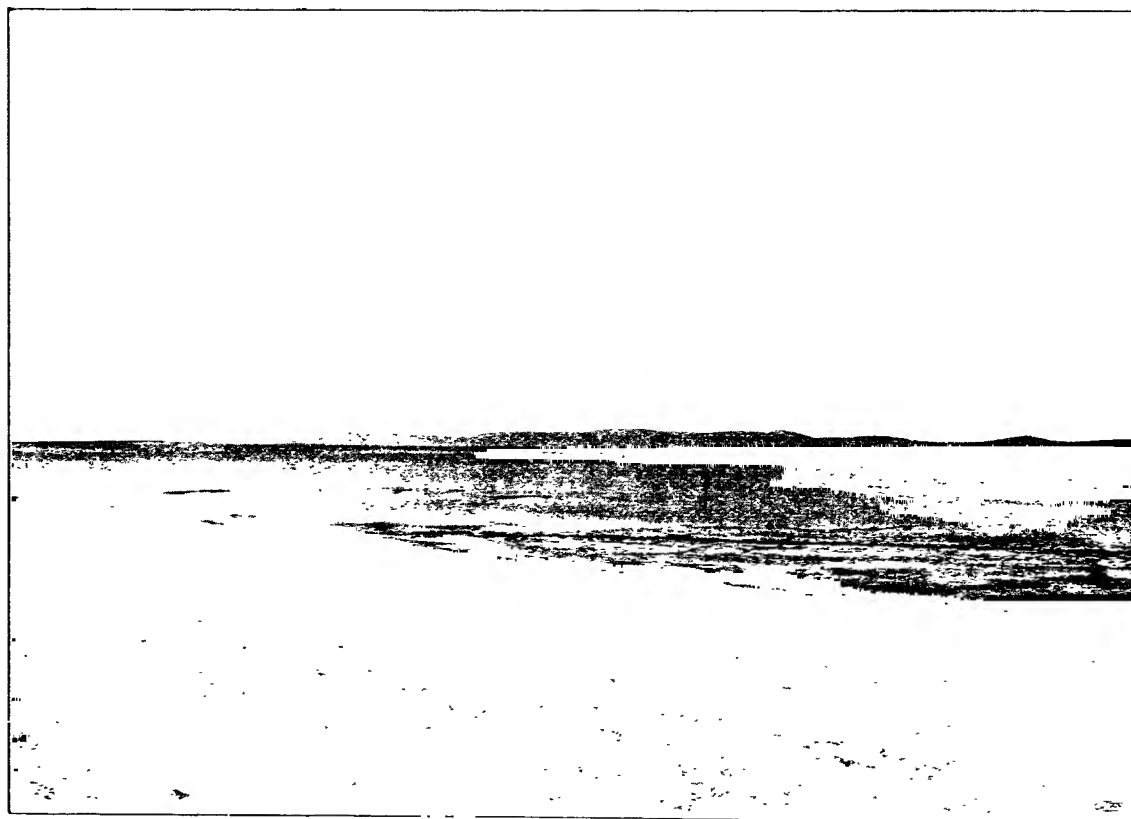


Fig. 77. S 65° E FROM CAMP XXX.

the excess of rainfall, which is heavy, to escape freely. Here too there were several waterless ravines. The strip of shore close beside the water's edge consisted of wet mud, with a number of small lagoons in it. The water was intensely salt, and so it was also in all the lagoons of the neighbourhood. We however were fortunate enough to find, not far from the lake, a spring which yielded drinkable water. Seen from the hills beside the lake, its northern half appeared to be of a reddish brown colour, its southern half on the other hand was blue; from which one is almost tempted to believe, that the former is somewhere entered by the turbid glacier stream. Next day however the reddish tinge had disappeared, and the lake was blue throughout. But as the northern part in particular is remarkably shallow, the turbidity was probably due to the beat of the waves.

The only hard rock we saw during the day consisted of two small conical knobs of porphyry. During the whole of the first half of the march the gravel consisted of black clay-slate and crystalline schist. During the second half it consisted of a peculiar amorphous, yellowish grey variety of rock, which upon being struck exhibited a conchoidal fracture. Otherwise all the hills in the neighbourhood consisted of soft disintegrated material and of sand.

The 22nd of August was devoted to an exploration of this extremely peculiar lake, the surface of which, in the gloriously calm weather that prevailed, stretched like an expanse of glass right away to the low hills which bordered it on the south.

From Camp No. XXX (alt. 4766 m.) the western shore appeared to bend principally towards the south, and by means of a reconnaissance I ascertained that it still maintained the same characteristics, namely low, grass-grown hills. The northern shore ran towards the east in an escalloped line. The shore-line is finely indented and forms a succession of small capes of moist mud, and quite close to it is a little ridge, composed of lighter gravel, and about 50 cm. high, which has been washed up by the beat of the waves. Mingled with this gravel, which is derived from the above-mentioned yellowish grey rock, there were also pieces of almost 1 cubic foot in size. Behind this strip of shore, which is 20 to 30 m. broad, rise the nearest sand-hills, not much more than 4 to 5 m. above the surface of the lake. But we searched in vain for any indication that the lake ever reaches a higher level. That its level does fluctuate is however probable, because the lake possesses no outlet and yet it receives a large river from the west, so that its level must be dependent upon the influx from this latter. It is however fair to suppose that just at that season the lake was at its maximum level, and that that reached exactly as far as the foot of the grass-grown hills. If the inflow in winter diminishes, the level must drop because of the evaporation. After describing the stream that supplies the lake, we will return to this question again.

Close along the water-line and stretching up from it is a continuous belt or crust of hard crystallised salt, 2 to 4 cm. in thickness. Although this upper crust broke under our naked feet, the ground underneath it did not yield, but bore perfectly: the foot did not go deeper than a couple of centimeters into the crushed salt, intermingled with red mud, and when we stepped into the water, it was stained red wherever we put our feet. The saline crust undoubtedly increases in thickness towards the middle of the lake, and when struck with a paddle some distance from the shore, it rang like a stone. In the same parts of the lake the saline crust was covered with a very thin layer of fine red sand, through which the salt showed. This sand is easily crumpled by the movement of the waves, so that in those places the bottom is striped or streaky. About 1½ km. from the shore, where the depth was still only about 1½ m., the water was for a short distance slightly muddy, but afterwards it cleared again; this was probably caused by currents from the river that enters the lake, or from other rivers which maybe issue into it.

My first line of soundings ran towards the S. 74° E., towards the southern cape of the only island in sight. Along that stretch, a distance of 4200 m., the depth was nowhere so much as 1 m.; in fact the entire lake is so shallow that I was able to use throughout the graduated paddle, rather more than 2 m. long. The soundings

which we took along the line I have indicated were 0.23 m., 0.46, 0.68, 0.79, 0.83, and 0.56 m. Thus a drop of only 0.83 m. would convert all this part of the lake into a single expanse of dry white salt, and the island into a peninsula jutting out from the northern shore. It is possible that something like this does take place every year or after cold summers, when the river carries a smaller volume than usual. As seen from Camp XXX the island really did look like a peninsula, for it seemed to be connected with the low-lying land behind it.

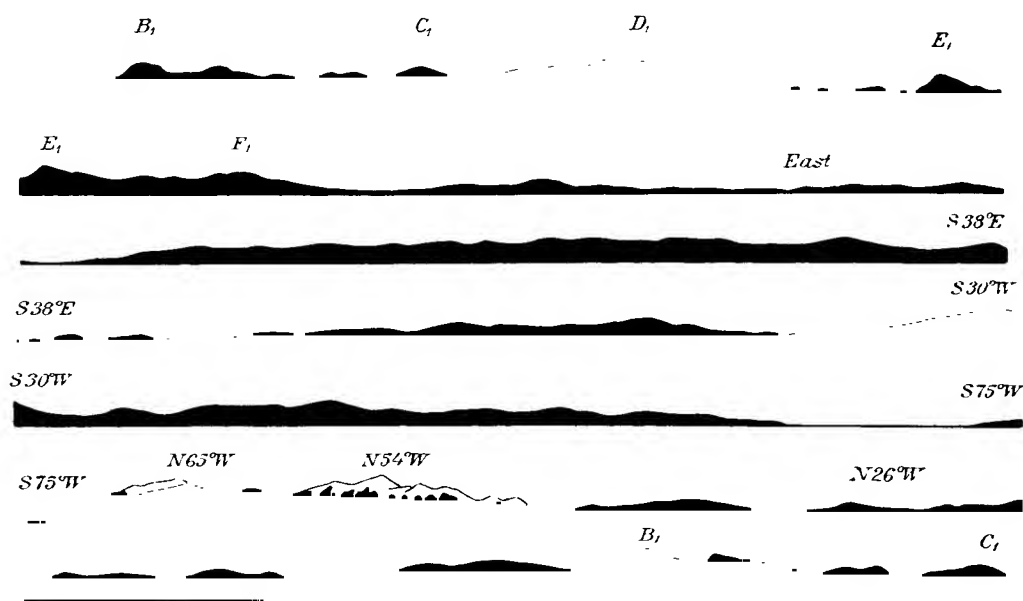


Fig. 78. PANORAMA ROUND THE LAKE, TAKEN FROM THE ISLAND.

The island is pear-shaped, the stalk a low, narrow, sandy promontory, pointing towards the north, so that the depth between the promontory and the mainland is probably very small. The island rises to its highest point, about 5 m., in the south-west; along its western side runs a low ridge, drooping towards the east and the north. This miniature plateau is clothed with excellent grass, which had never been touched, nor was there any sign that it is ever visited by either wild yaks or antelopes. These animals would have no difficulty in reaching the island, but either they never suspect that the lake is so shallow, or else their instinct tells them that in such a precarious situation they would be exposed to greater danger than usual from an attack by wolves. Besides, there are no doubt equally good grazing-grounds in more accessible situations, though this little spot was the best we saw in that part of Tibet, better at any rate than the grazing on the shores round the lake. This may to some extent be due to the influence of the salt water upon the temperature of the air. In the northern part of the lake the temperature of the water in the morning amounted to  $14^{\circ}$ , but it no doubt drops a few points on a frosty night. During the autumn and early winter this extremely thin layer of water will be cooled pretty rapidly down below  $0^{\circ}$ ; but before that happens the lake will also to some extent have moderated the cold around its shores.



*Instr. A. B. Lagvelius & Westphal*

CROSSING THE RIVER WITH THE HELP OF THE CANVAS SKIFF.





There were no insects of any kind on the island; the only sign of life we discovered was the leg-bone of a bird. Two gulls were seen flying towards the west, making pretty certainly for the large freshwater lake which exists in that direction. As for the water, its excessive salinity is enough to show that it is entirely destitute of life; neither plant nor animal could possibly live in it. Moreover the strip of shore itself is also absolutely barren as far as the waves reach up it, that is to say as far as the foot of the encircling hills. There was also a similar strip of mud round the island, with fragments of the same greyish yellow stone that I have already alluded to, curiously shaped like saucers and balls. The strip along the western side consisted entirely of gravel of that kind.

About 400 m. west of the southern cape of the island there are several small banks of gravel, rising barely one foot above the surface of the water, a miniature archipelago that extends for several hundred meters and forms a semicircle convex towards the west. Beyond this curving line, but below the surface, there are a great number of similar banks, a good deal smaller in size, but all consisting of gravel. I felt strongly tempted to identify them with the ridges of ancient moraines which are now for the most part embedded in the mud and salt, after filling and levelling up the deep depression that formerly existed here. The regular semicircular form makes it difficult to account for them in any other way. The island however bears no resemblance to a fragmentary moraine; it may possibly be the last remnant of a small belt of sand that originated at a later date. At the present time the nearest glaciated mass to the east or north-east lies a very long way off. We saw no similar formations in any other part of the lake.

The island afforded a magnificent view of this lofty plateau-land of Tibet, but unfortunately the summits of which I now took the compass-bearings were later on veiled in mist and cloud. The stupendous glaciated mountain-mass (V) still towered high above all its neighbours, and stood N.  $54^{\circ}$  W. In the N.  $65^{\circ}$  W. was a lofty snowy mass. To the west the new latitudinal valley was quite open and level, and nothing broke the line of the distant horizon. A ridge of rather low, rounded hills rose quite close to the southern shore of the lake, but nowhere did the bare rock crop out. In the S.  $38^{\circ}$  E. there was what appeared from the island to be a saddle or droop in their outline; it was in reality a gorge running through them. The mountains on the northern shore of the lake are overtopped in the north-north-east and north-east by several dominating peaks. The cape that projects farthest south was visible in the S.  $86^{\circ}$  E. The waters from springs and melting snows on the mountains both north and south are gathered up into a main stream, which probably enters the lake near its extreme eastern end.

Upon leaving the island we steered diagonally across the lake towards the S.  $50^{\circ}$  E., guiding our course by an upstanding, conspicuous hill. The distance to the shore amounted to 9450 m. Immediately round the island there was a circular belt in which the crust of salt was absent, its place being taken by gravel resting on blue plastic clay. But very soon the hard salt began again, and its whiter-gleaming corrugations and ribbings, which appear to be formed when the water drops so low as to expose the salt crust, were distinctly visible at a depth of  $1\frac{1}{2}$  m. Thence the salt crust extended right away to the vicinity of the southern shore.

The water was impregnated with salt to an extraordinary degree, this being the saltiest lake I encountered in Tibet. Everything that came into contact with it turned white. When we let the water dry on our hands, it left them with a disagreeably rough feeling. The crystals of salt sparkled on the paddle-blades. The water was a greenish colour when you looked straight down into it, but farther away it assumed different tints of light blue owing to the reflexion of the sky above.

Viewed from the lake, the mountains do not bulk very largely upon the scene. The bigger elevations, which are *per se* flat, are at too great a distance, and the smaller ones, which encompass the lake, melt together into a uniform brownish grey. Nevertheless I think I succeeded in making out that the summits of which I had previously taken the compass-bearings — B<sup>1</sup>, C<sup>1</sup>, D<sup>1</sup>, E<sup>1</sup>, and F<sup>1</sup> — do not belong to one and the same mountain-range, but to two or three more or less broken ranges (fig. 78). But the same inflexible law of parallelism still prevailed, in that all the ranges still stretched east and west. D<sup>1</sup> is a snowy mass crowning the centre of the most important chain, which is of a brick-red colour, and appears to terminate pretty abruptly at both extremities.

In the morning the lake had appeared to stretch to an immense distance towards the east; but in the afternoon the distance turned out to be not so very great, for we were able to see the eastern shore quite distinctly. When the sun got round to the west, the shore in that quarter appeared to be excessively distant. This circumstance was due not only to the course we were taking and the distance we had already travelled, but also to an illusion or mirage, caused by the position of the sun. When the sun's rays fall upon the shore, it stands out distinctly; but when sun and shore are both on the same side of the spectator, the latter disappears as though a haze or curtain of vapour hung over the water, blurring the outlines in such a way that water and sky seem to melt together.

Early in the afternoon the water out in the middle of the lake had a temperature of 17.°1 and the temperature of the air at the same time was 14°, the former being several degrees higher than the mean temperature of the air at that season of the year. This points to a surplusage of heat stored up during the summer months.

This lake was even shallower than the Upper Kum-köl. Between the island and Camp XXXII we measured the depth every ten minutes as we paddled along. At first the soundings increased successively by only a couple of decimeters or so, afterwards by only one or two centimeters, and then remained constant at about 1.88 for several kilometers. Along the line we took the several soundings were as follows — 0.82, 1.20, 1.31, 1.34, 1.76, 1.81, 1.87, 1.88, 1.89, 1.89, 1.89, 1.88, 1.88, 1.85, 1.87, 1.87, 1.88, 1.91, 1.97, 2.03, 2.05, 2.17, 2.33, 2.29, 2.31, 2.01, 1.10, 1.00, and 0.90, the last-named being taken ten or a dozen meters from the southern shore. It can only be pronounced a very unusual and peculiar circumstance that in a distance of 3250 meters the depth should not vary more than 3 centimeters. To construct a bathymetrical map of a lake-basin such as this would serve no purpose, for the curves would vary only by decimeters, and in the middle of the lake by centimeters only. In fact in a case like this one can hardly speak of relief at all. It would have been almost equally purposeless to have taken any great number of soundings across the lake, for every-

thing suggested that its character all over its area remains precisely what it was along the line where we did take soundings. It is at any rate highly improbable that any other part of the lake is deeper than  $2\frac{1}{2}$  meters, for it must be remembered that we crossed it diagonally.

Owing to a strong gale springing up from the east in the afternoon, we altered our course during the last portion of the journey towards the S.  $50^{\circ}$  W. But while the northern shore shelves very, very slowly, off the southern shore we obtained a depth of 2.01 m. at a distance of 800 m. out, and we were able to paddle all the way to land, which consisted, not of mud, but of sharp-edged gravel, the debris of a black schist. There was a deep, narrow miniature bay, with a lagoon inside it, and both white with salt under a sheet of water about one centimeter deep. The ground between the edge of the lake and the nearest hills was undulating and bore japkak scrub.



Fig. 70. CROSSING THE RIVER AUG. 24, 1900; LOOKING DOWN THE RIVER TO THE EAST.

On 23rd August we took a series of soundings between Camps XXXI and XXXII, the direction being towards the N.  $75^{\circ}$  W., diagonally across the southwestern part of the lake. Here we obtained the following depths — 2.07, 2.37, 2.26, 2.05, 2.01, 1.84, 1.42, 1.08, and 0.60 m. Thus the maximum depth along this line was only 4 cm. more than that along the former, and this, 2.37, was the maximum sounding we obtained anywhere in the lake. If, disregarding the third series of soundings,

which were taken too close to the western shore, we confine our attention to these two series alone, we find that the mean of 44 soundings for this lake is 1.6 m. In the Kum-köl we obtained a mean depth of 1.12 m.; but if we make allowance also for the areas of the two lakes, then the salt lake is the shallower.

According to my areometer, the salinity of the water at Camp XXXII was 1.22. But the value of the reading is to this extent impaired, that the fresh water from the river unquestionably reaches that far, so that here near the western shore the salinity was a good deal less than in the middle of the lake.

On the north of Camp XXXII the shore-line swung out into the lake, and there too there were sand-hills thinly clothed with grass, and containing amongst them one large and two small pools.

August 24th. From the last camp we sounded a line that ran at first towards the south-south-east and then towards the south-west to the mouth of the river. Along this line the depths obtained were — 0.51, 0.78, 0.97, 1.04, 1.08, 0.97, 0.90, 0.41, 0.71, 0.61, and 0.80 m. We were barely a kilometer from our starting-point when the movement of the river made itself distinctly felt in the shape of a heightening of the level, which formed a slight concentric wave across the calm mirror-like surface of the lake. Quite close to the mouth of the river the velocity amounted to 0.53 m. in the second, and at the left or northern horn of the river-mouth to 0.30 m. Thence the river water spread itself out fan-like across the lake, though principally towards the north-east, this direction being dictated by the shape and orientation of the last basin in the estuary and by the slight projection of the horn at the north side of the river-mouth. The distance between the two horns of the estuary amounted to 330 m., and along this line we measured from north-west to south-east depths of 0.79, 0.86, 0.95, 1.13, 1.19, 0.76, and 0.25 m. Just outside this line we observed a semicircular gravel bank, convex to the east, everywhere about half a meter below the surface; but in the middle, where the current ran strongest, there was a trough 7 m. broad and 2.56 m. deep, this spot being deeper than any other in the lake. Within the horns of the estuary there is thus a basin, or if you like an expansion of the lowest part of the river. At the south-east angle of this basin there is a deep but shallow bay, formed by a peninsula projecting towards the north-east. Between its northern extremity and the northern bank the river is narrow, and flows with a lively current. There is also another basin or expansion west of this narrow fluvial passage. The river appeared to come from the N.  $77^{\circ}$  W., where we observed an opening between the banks, while a little farther west lies the freshwater lake from which the river issues. In both these basins, as well as outside the estuary we saw the fresh water commingling with the salt, and giving rise to flocculent intrusions and streaks as in sugared water. Both waters were as bright as crystal; in the narrow passage, even at a depth of 3.34 m., the bottom was perfectly clear and distinct. The upper lake thus serves as a filtering reservoir, in which the thick, muddy glacier rivers deposit their sediment. From this we may infer, that the upper lake is pretty large and deep, but that it will in process of time be filled up by the solid material which is thus deposited in it.

It is interesting to observe that this salt lake lies at an altitude of only 4766 m., and consequently in what is relatively an unusually deep depression for this part



TRANSPORTING A CAMEL ACROSS THE RIVER.



*Ljustr A. B. Lagrelus & Westphal.*

A CAMEL LANDING.



of Tibet. One would have to travel a considerable distance to the north as well as to the south in order to reach another point that lies as low as this.



Fig 80. Left. 

0.96	1.77	2.41	2.45	2.82	3.34	2.83	2.51	2.14	1.23
63	72	79	80	87	86	91	89	83	69
24	1	73	70	33	66	35	15	48	77
	-3	10	40	20	31	19	9	9	2
	-11	1	24	4	20	19	6	1	0

 Right.

Breadth = 58 m. Camp XXXIII. Aug. 24th.

At the place where we measured the river, the left bank makes, as the accompanying profile shows, a decidedly steep terrace, about 2 m. high, while the right bank is formed of the flat and narrow peninsula I have just mentioned, its surface being barren and strewn with gravel. Here the river had a breadth of 58 m., its maximum depth was 3.340 m., its mean depth 2.052 m., its mean velocity 0.3634 m., and its volume 43.25 cub.m. in the second. Owing to the perfectly regular shape of the river-bed



Fig. 81. A CAMEL AND A SHEEP CROSSING THE RIVER.

the velocity decreased fairly uniformly with the depth. On the surface the current was lively, 0.744 m. on the average, with a maximum of 0.846 m. At a depth of 0.80 m. the mean velocity was 0.408 m., and the maximum velocity 0.716 m.; at 1.35 m. the mean was 0.127 m. and the maximum 0.372; at 1.75 m. the mean was 0.065 m. and the maximum 0.223 m. Thus at the depth of 1.35 m. the mean velocity was only one-sixth of what it was at the surface. A counter-current flowed at the bottom close under the left or northern bank, and it is not improbable that there exists another counter-current in the deepest



part of the river; but unfortunately I was unable to satisfy myself of this, for the current ran too strong for the thin tent-spars which I used (having nothing better) for sinking the velocity-instrument. If there really does exist a second counter-current at the bottom, it will of course affect the figures I have given above, and the volume will be less than I have calculated it. But as a matter of fact the only counter-current we actually observed was that close to the left bank. And yet there must of necessity exist a counter-current along the bottom, for the maximum depth of the lake amounts to 2.37 m. or, if we count the estuary as belonging to the lake, to 2.56 m., while the actual river itself reaches a depth of 3.34 m. The salt water therefore in consequence of its weight is forced up against the freshwater stream, and driven in between its lowest layer and the bottom of the river. All the same the under-current of salt water cannot ascend higher than to a point at which the depth is slightly less than the depth of the lake, and at which consequently all the fresh water flows eastwards unchecked over a ledge or threshold, and this at the same time prevents the under-current from continuing towards the west. Upon reaching this ledge the salt water becomes mingled with the fresh, and is forced to turn and flow back on the surface towards the east, in the way shown in the accompanying sketch (fig. 82). That the fresh and the salt water really do intermingle in the narrow passage which we measured is perfectly evident from the fact, that the water at that point is already salt, for the areometer gave there the reading 1.036. But in the outer basin immediately below the place where we got this reading the salinity was 1.051, and at Camp XXXII it was 1.22, and no doubt it continues to increase towards the east. The deepest point between the two horns of the estuary was only 1.19 m., but even there there was a powerful under-current of salt water. At the narrow passage where we took our measurements the fresh water had however already begun to assume the upper hand. The Crustaceans and other small aquatic creatures which drifted with the current down from the freshwater lake were all dead even before reaching the narrow passage. The two basins may be regarded as a transitional stage between the freshwater lake and the saltwater lake. In them the salinity is already so great that all traces of both animal and plant life are absent; the hard, sandy, gravelly bottom is completely bare.



Fig. 82.

My plans did not admit of any stay at this spot, but I hasten to add that it would be well worth while to spend a couple of weeks beside this interesting pair of lakes, and I recommend the task of examining them to the future traveller in that region. I am unable therefore to state how far up the salt water penetrates, nor can I say whether or no the two large lakes are linked together by a series of smaller ones. If that is the case, then the latter lake will decrease in salinity from east to west. We saw however quite distinctly the spacious expanse of the upper lake, which likewise stretches from east to west. The distance between the two lakes did not

appear to be more than a few kilometers. The difference of level between them is wonderfully little. The velocity of 0.846 m. in the second prevailed for only a very short distance in the narrow passage; above and below it the velocity was slight. And the same thing was no doubt true of the rest of the way up to the upper lake. I dare say the difference of level did not at that time exceed a couple of decimeters.

The upper lake is fed by the voluminous glacier brooks that flow down from the glaciated mass V, that is to say the whole of the region round about our two Camps XXVIII and XXIX. The large stream into which these brooks gather enters the lake on the north. Streams of thaw-water from other snowy mountains, which we saw to the west of that glaciated mass, likewise eventually make their way down into the same lake, and I have no doubt it also receives another considerable river from the west. On the other hand it does not appear to receive any noteworthy affluent from the south. All this water gathers into the stream that enters the salt lake, this being the deepest depression and collecting basin of the entire region. How large this self-contained basin of internal drainage is, it is impossible to say; but probably it is one of the largest in Tibet. The river at any rate was the largest I measured during that excursion, and indeed it was only exceeded in size by one other river out of all those that I subsequently crossed over in Tibet proper.



Fig. 83. SAFF ACROSS.

We might infer *a priori* that the area of the salt lake is great, when we know that its mean depth is only 1.6 m., and that it at the same time receives 43 cub.m. per second. Moreover it may safely be assumed that this is not the only inflow into the lake; for even though we did not see any conspicuous snow-field towards the east, nevertheless all the thaw-water in that direction must flow down into a main stream, which traverses the eastward continuation of the latitudinal valley, and it too

must make its way into the salt lake, for it lies, as I have already said, lower than any other lake in this part of Tibet. The trip I made across the lake is far from being sufficient to determine its area; but estimating it at 110 sq. km., and taking the mean depth at 1.6 m., this gives us a cubical capacity of 176,000,000 cub.m. If the river contributes, as it was doing then, 3,715,200 cub.m. in 24 hours, it would take 47 days to fill the lake, and the time would be shortened in proportion to the quantum contributed by the eastern stream, and any others that may enter the lake at other parts. If therefore the lake is to remain at the same level, then at least some 4,000,000 cubic meters of water must evaporate every day. In view of this active circulation, it is only natural that the salinity should be considerable, and it will go on increasing year after year.

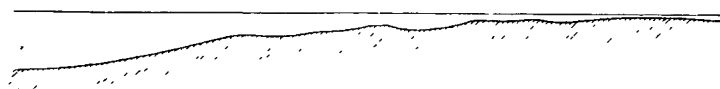


Fig. 84. WATER FLOWING FROM DEEP RIVER INTO SHALLOW LAKE.

The peculiar character of the lake indicates however that the whole of its water evaporates every year, so that in the spring all that remains must be the salt crust, though it does no doubt contain a few scattered pools of salt water. Since the lake requires an influx of 43 cub.m. per second to maintain its level unchanged, it would, if its inflow were to be cut off, dry up in a month and a half. The upper lake is fed entirely by glacier streams and rain. Both these sources of supply are sealed during the winter; and even if there is any precipitation at that season, it lies in the form of snow, and evaporates on clear days, or else goes to swell the earliest torrents of spring. At all events the upper lake derives no increment from perennial springs, or if it does the amount is infinitesimally small. The lake does, it is true, act as a regulator of its emissary, so that once a certain equilibrium is attained, this will remain pretty constant all the summer; but in the winter the volume must gradually approach a minimum, which may perhaps be equivalent to *nil*. That this must be so is easy to prove; for if we suppose both lakes to be of the same size, and if the lower lake becomes filled in 47 days, the upper lake would in that same period lose a volume of water equivalent to a layer 1.6 m. deep. But it is also to be remembered that the upper lake is in its turn also exposed to evaporation, and that both lakes need only drop 1.19 m., the measure of the deepest spot between the horns of the river estuary, for the connection between them to be severed. Meanwhile the upper lake, whilst it is being continuously fed, though at varying rates in consequence of the changeable weather, maintains during the summer at the same time, by means of its regulative influence, a steady and constant flow in the efferent stream. Even in the autumn, when the supply of water from the glaciers diminishes, and finally ceases altogether, the lower lake will always drop at a quicker rate than the upper lake, for while the latter then becomes frozen over, the salt lake always remains open, and so its evaporation goes on uninterruptedly. The presence of freshwater fauna in the upper lake proves that the salt water never under any circumstances penetrates into its basin.



CAMP XXXIV.



*Ljustr A B Lagrelins & Westphal.*

CAMP XXXIII ON THE SOUTHERN BANK OF THE RIVER.







The relief also of the salt lake indicates that the whole of it evaporates every year, the salt becoming crystallised on its bottom. In the north, where the lake is shallowest, the water-line will slowly retire from the base of the hills; and the island and the little archipelago will become connected permanently with the shore. The water will remain longest in the south, where the depth is greatest, and will there assume the shape of a long, narrow strip. As this process is repeated annually, the effect of the crystallisation of the salt is, in the course of the centuries, to fill up the lake-basin more and more. It is only in this way that we can explain the fact, that for several score square kilometers the saline crust is almost as smooth and level as the surface of a mill-pond. The greater variation in the depth along the southern shore may possibly point to the actual continuance of water in that locality during the winter, and suggests that this is augmented, though it will be to only an extremely small extent, from the upper lake. The more the lake shrinks, the larger is the quantity of salt deposited, because the limit of saturation becomes more and more exceeded. Hence the thickness of the salt deposit increases steadily from north to south. In the spring, when the inflow is increased in proportion as the snow and the glaciers melt at an accelerated rate, and the rain begins to fall, so does the lake swell again, its northern shore-line advances once more towards the north, passing the island, until finally it reaches the base of the hills, and the salt that has been concentrated during the preceding winter is once more gradually covered with water. The water that manages to survive the winter in the southern part of the lake becomes at the same time charged with salt; but when the spring freshets grow stronger and their supply more copious, this water becomes intermingled with larger and larger quantities of fresh water, and so the point of saturation is departed from, at any rate for a time. But since the salt crust is covered during the summer, and the temperature of the covering water is, as we have seen, raised to  $17^{\circ}$ , it is pretty certain that some portion of the crystallized salt will be again dissolved; though, when the following winter comes, it will once more be concentrated. Simultaneously with this its quantity and thickness are being continually increased by the salts in solution, which are brought down by the rivers and brooks from every part of the self-contained drainage area. Were one in a position to visit this lake in winter, one would probably be able to confirm, not only the correctness of the inferences I have drawn, but also the fact that the deposit of salt, which for centuries has been accumulating in the central parts of the lake, has already attained to a great thickness, and that we have here going on before our very eyes the lithogenetic process of the formation of rock-salt. All the salts which are set free throughout the whole of that drainage basin by the agency of water must eventually find their way down into this lake and reservoir, which is indeed being steadily filled up by them. The corrugations and ribbings which I have already mentioned as diversifying the surface of the salt crust also appear to indicate that the lake dries up, giving rise to changes in the consistency of the salt-crust.

If now we suppose, that, while the inflow remains constant, the deposit of salt at the bottom of the lake rises higher and higher, then the area of the lake ought to increase and its level to rise in proportion to the area and level of the upper lake; but if the area increases, so too will the evaporation. When finally the basin



is quite filled up with salt, and even to some extent also with sand and mud — these being introduced by the other streams from the east — then it will be the turn of the upper lake to become salt. But since we know, independently of this, that all the lakes of Tibet are decreasing in consequence of climatic changes, it is to be supposed that there is also a secular diminution of the inflow into the upper of these two lakes, the consequence being that there is also a diminished flow between it and the lower lake. Hence the probable goal towards which the hydrographical circulation of this basin is tending is, that the inflow from the upper lake will some day cease entirely, and that it will then enter upon the same stadium which the lower lake is now passing through; while at the same time the latter will be converted into a dry salt pan, which, through the agency of the wind and the continued weathering, will become covered with soft, loose matter, and possibly also with dunes. Yet a considerable period must elapse before that stadium will begin, for at present there is still a pretty copious discharge from the upper lake.



Fig. 85. SKINNING A SHEEP.

If now, as I have supposed, the salt lake for the most part disappears during the winter, then, even before this happens or rather as soon as the lake level has dropped 1.19 m., the shallow threshold between the horns of the estuary will be laid bare; yet not entirely so, for the water will still continue to flow through the trough in the middle of the passage, although in diminishing quantity as the winter advances. At the same time it is of course impossible for the salt water to penetrate into the two basins, which consequently get rid of their salt water, until in the end they probably become fresh. It is not improbable that all inflow into the lower lake ceases entirely owing to the water freezing in the shallower parts of the narrow passage.

In some respects these twin lakes and their basin bear a certain resemblance to the basin of Kum-köl; that is to say there exists a certain symmetry between

them. In the Kum-köl there are also two lakes — the upper one, containing fresh water, sends an emissary to the lower lake, the terminal basin of the system, which is consequently salt. The Kum-köl lakes lie quite close to the foot of a mountain-range, from which they do not receive any noteworthy influx, almost the whole of their supply coming from the opposite or southern mountains. Precisely the same thing is true of this new pair of lakes which I discovered due south of the Kum-köl lakes: they too lie close to the foot of a mountain-chain, but at a great distance from its *vis-à-vis*. From the former they receive no influx; it all comes from the latter. The spring brooks in the Kum-köl basin flow towards the west, and after they have converged into one stream, this flows towards the north. The



Fig. 86. OUR LAST LIVING PROVIDER.

stream of the new twin-lakes flows at first towards the east or south-east, and afterwards towards the south. Again, in the former basin the deepest depression lies in its northern part; in the latter in its southern. The two basins are separated by a swelling of the highland, namely the parallel ranges of the Arka-tagh. The northern basin is the more pronounced, and gathers up the precipitation from several parallel ranges. The southern basin is separated from the true main range of the Arka-tagh by a couple of other latitudinal valleys, each with self-contained basins, and it gathers its water off one chain only. In the northern basin the deepest part of its long east-west depression occurs towards the western end, that is to say the salt lake lies west of the freshwater lake; in the southern basin the relations are reversed, and the salt lake lies east of the freshwater lake. This however has little to do with the general hypsometrical architecture of the highland region; it is simply an accidental characteristic of the morphology of the two basins. In a word, the deepest part of the northern basin lies in its north-western part, and the deepest part of the southern basin in its south-eastern part.

But there exist also great differences between the same two basins. One difference is that in the northern basin the salt lake is much deeper than the freshwater lake, and its maximum depth is ten times greater than the maximum depth of the salt lake in the southern basin. In the latter it is undoubtedly the freshwater lake which is the deeper. Moreover the two salt lakes are at very different stages of development. The northern, Ajagh-kum-köl, is a large lake, and its area and level certainly change but little during the course of the year, while its water is a long way from being fully impregnated with salt; hence it is only under certain specially favourable circumstances that concentrated salt deposits are found around its shores, e. g. in the shallow lagoons that are at times cut off from the lake. But we have seen that the southern lake has advanced much nearer to that stage in its existence in which it will have ceased to act as a salt reservoir, because its basin will be entirely filled up with crystallized salt. The function which this peculiar salt lake performs in relation to its freshwater twin bears no little resemblance to the function which the vast lagoon of Kara-bughas or Adschi-darja (the Bitter Sea) exercises in relation to the Caspian Sea. Fresh water flows constantly into the lagoon through a narrow opening, the Kara-bughas Sound, situated between two flat, natural pier-like arms, and as the lagoon is surrounded on every side by arid deserts, it is consequently exposed to a very active evaporation. This lagoon and salt-collecting basin is extraordinarily shallow in relation to the vaster area of the great sea which feeds it. The comparison halts however in consequence of the disproportionately great difference in the dimensions of the two basins. The Kara-bughas exerts no influence upon the salinity of the Caspian Sea, which is certainly increasing, because the evaporation exceeds the inflow, causing the sea to shrink in area. Our salt-lake however acts upon the freshwater lake like a distilling apparatus, extracting from it its salt; and the thoroughness with which it does this must be great, because of the small area of the freshwater lake coupled with the copious volumes of fresh water that flow into it. Thus, even though we might with some show of reason compare the salt lake with the Kara-bughas, it would nevertheless be absurd to compare the freshwater lake with the Caspian Sea. I shall however return to this matter, to other geographical homologies that exist, and to a comparison between this basin and its neighbours, when I proceed to deal with the general *résumé* of the hypsometrical and morphological relations of the Tibetan highlands. All that I will add here is, that in those parts of it which I visited I nowhere found hard rock, nothing but sand and soft yellow soil. As rocks approach nowhere quite close to the shore, it may be assumed that the same circumstances prevail throughout, or in other words, that these lakes have been formed amongst the extremely finely pulverised, disintegrated materials which during countless centuries have been at work filling up this basin; the basin itself having originated when the mountain-ranges to north and south of it, which are now for the greatest part planed away, formed gigantic folds of the earth's crust, folds which are far better preserved on the north and on the south, i. e. in the peripheral parts of the Tibetan protuberance; in fact so far is this the case that in the south they still support the loftiest peaks that exist on the face of the earth. Now the range which borders our twin-lakes on the south is, as we shall see in our next day's march, ridiculously unimportant, with regard to both height

and breadth; in fact it is hardly worthy of being called the ruins of a mountain-range. Certainly it cannot in any way compare with the range that borders the northern basin on the north, that is to say with the imposing and rugged chain of the Kalta-alaghan.

During the last four days a distinct change had taken place in the weather. The wind blew predominantly from the east and the downfall was very much less than before. The reason of this is that our basin forms a relatively low-lying portion of eastern Tibet, and the circumjacent mountains intercept the precipitation. On the afternoon of the 24th August we had a violent squall from the north-east, with thunder and lightning, and the rain continued, although less violently, even after the wind had veered round to the east, and was blowing with a velocity of 13 m. in the second. Were the rainfall not so evenly distributed as it actually is, this highland region would present all the necessary conditions for the origination of a drift-sand area. In every direction there exist completely disintegrated or ruined mountain-ranges, in every direction the ground is covered with the finely comminuted material they have yielded, which, were it but dry enough, would be inevitably seized upon by the wind, and, after having been duly sifted and sorted, would be converted by it into dunes. Such vegetation as exists is so very insignificant, that its retarding effect upon the wind's activity would be infinitesimal. Seeing then that dunes are so rare — apart from those of Kum-köl we only saw minimal dune formations in two or three other places — we must turn to the precipitation to ascertain the cause of this. A downfall of rain or snow, intrinsically unimportant, is quite sufficient to prevent completed dunes from moving, and also to check the origination of dunes in places where nevertheless all the other necessary conditions are already present. On the Tibetan highland the precipitation is more than sufficient to create the requisite check, and the formation of the large dunes which do exist in the Kum-köl basin must be due to quite special circumstances, such as a more distinctly periodical rainfall with intervening periods of drought. A region such as that which we travelled across from the Arka-tagh offers an insurmountable barrier to the removal of the sand which already exists there. As we have seen, not only is the surface moist, but the moist condition certainly penetrates to a considerable depth. During the summer scarce a day passes without downfall of some kind, so that the surface of the ground is kept constantly moist, while at the same time vast quantities of water search their way vertically into it. We have also supposed, that the rainfall during the winter is but slight, at all events incomparably scanty as compared with the summer rainfall. Will not the ground then dry, so that its light and volatile material will fall a ready prey to the wind, which in winter would seem to be more violent and more constant than it is in the summer? No, that does not happen, for late in the autumn the saturated soil freezes and turns as hard as stone, so that when struck by an iron bar the white splinters fly like ice, and thus it effectually renders all wind-transportation impossible. We shall indeed come across dunes once or twice in the sequel, but both in respect of altitude and of extent they are extremely unimportant. Broadly speaking, it may be said that the origination of dunes in Tibet is rendered impossible by the precipitation.

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## CHAPTER VIII.

### A TIBETAN LAKE-LAND.

August 25th. Leaving the peninsula on the extremity of which our Camp XXXIII stood, we passed between some small pools, heavily impregnated with salt, and proceeded towards the south-south-east, ascending the gently rising hills which border the twin lakes on the south. From these hills flat, softly rounded offshoots

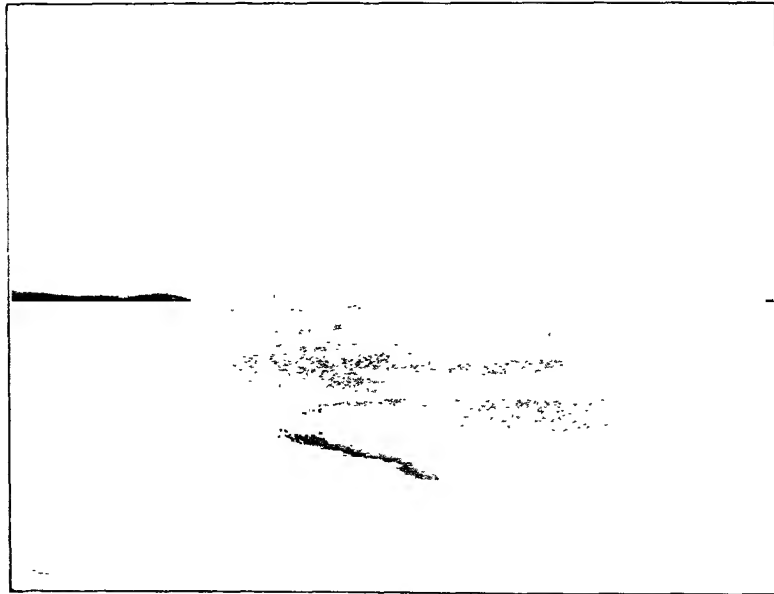


Fig. 87. WESTERN PART OF THE LAKE, LOOKING NORTH.

run out towards the north-west. Between some of them small rivulets would appear to flow at times, making for the upper lake, yet so insignificant are they that it is doubtful whether they ever get down as far as that. Only a very short distance after fording the river we came upon a few small pools, into which trickled some rivulets of perfectly fresh water issuing from springs. From the tops of the hills we were able to command a view of the connecting river and its expansions, which appeared to grow larger towards the west; we could also see the upper lake, but all alike were soon screened by the first heights we crossed over.

The grass here was thick and fresh, though too short, and through it trickled from every direction a number of rivulets, which emptied into a larger pool. There was also a large quantity of yak-dung in this locality. Shortly after that we reached the culminating point of the hills, and thence beheld another self-contained basin, embracing a lake of no great size (fig. 87). The latitudinal valley in which this basin is situated is exceptionally narrow. The western border-ridge of the basin appeared to be not very far away, because the stream that we saw flowing down into the lake was not very deeply trenched. In the west too there were heights, and the dividing ridge in that direction seemed to be higher than usual. The slopes of the hills were green with grass, and here there were several large herds of yaks grazing. But both they and the country were soon blotted out for us by a hail-storm, which continued without intermission for three hours.

After fording the stream in the new valley, we struck along the west shore of the lake, and consequently gradually inclined to the south-east and east-south-east. The water in

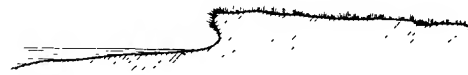


Fig. 88.

the lake, although not perfectly clear, was practically fresh, the slightly brackish taste it had being quite evanescent. Here we found again the same small Crustaceans that we had observed in the freshwater lake of Kum-köl. All along the western shore, and in part also along the southern, was a rim or braiding of grey withered grass still attached to its roots. For Tibet the grazing was excellent all round the lake. On the south the lake is entered by a stream of very uncommon shape. It is more like an elongated bay, now narrow, now expanded, but we soon made out that its water was flowing, though excessively slowly, towards the lake. Its upper part made a broad basin, into which gather the tiny rivulets that issue from springs in the adjacent hills on the south. On the lake there were large numbers of wild-geese. The absolute altitude of this lake is 4790 m.

South-west of the lake rises a ridge or mountain-spur with rounded outlines; it is built up of soft materials and is continued eastwards by another similar ridge, not very high. Between the two flows the stream I have just alluded to; its upper part coincides with the deepest passage in the meridional glen that separates the two ridges one from the other, and affords an easy means of crossing the insignificant and defective parallel range from which they jut out. To the east the country is open. This latitudinal valley does not appear to be of the same rank as those we have hitherto encountered; it seems to be merely a secondary depression. The circumstance of its water being fresh renders it probable, that it cannot be regarded as the terminal basin in a self-contained drainage area. Still it possessed no visible outlet; but there is, I dare say, an underground emissary, and in that case it will carry off the surplus water into the large salt lake situated immediately to the north of it.

The ledge or threshold of the meridional glen is extremely flat and level, and dotted over with numbers of pools. Thence we saw to the south-west a glaciated mountain-mass and to the west-south-west a black jagged mountain with snow on its highest summits. We pitched Camp XXXIV (alt. 4805 m.) immediately north of a little brook that flowed to the east; the grass still continued to be good.

That day we only saw hard rock twice, and it barely projected above the ground, which consisted of soft disintegrated material. The rock was black crystalline schist, belonging to a ridge south-west of the lake, and dipping  $56^{\circ}$  towards the S.  $50^{\circ}$  E. and  $54^{\circ}$  towards the S.  $60^{\circ}$  E. All the gravel we saw consisted of the same material.

During the two following afternoons and evenings it rained with extraordinary smartness, so that by the 27th August the ground in the bare, barren places was again soft and miry. As a rule however it still continued to be grassy, and consequently bore us. The rain caused the brook south of our camp to swell, and its water turned a muddy red colour. It was 17 m. broad, had a mean velocity of 0.3 m., a mean depth of 0.4 m. and a maximum depth of 0.6 m., and a volume of 2 cub.m. in the second. It appeared to issue from the mountain-group G', which rose to the S.  $70^{\circ}$  W. So far as we were able to see for the hills, the brook continued on towards the east, and it hardly seems possible that it can be connected with the two rather large pools which lie to the south of it, or can even touch them, because they are of a bright blue colour, whereas the stream was, as I have said, muddy. Probably the brook makes its way to the next salt lake to the south. The more westerly pool of the two is entered by a small brook from that same direction, and apparently it continues as far as the eastern pool.

South of these two pools the country again rises to a low swelling, from the top of which we obtained as usual a view of the next salt lake, inclosed between two series of low heights. Those on the south-east were so low, that we caught glimpses of yet other sheets of water gleaming beyond them. But on the south of them was a pretty considerable mountain-range, forming the boundary of the lake-basin on that side. Close to the shore we passed yet another large pool, likewise entered by a little brook from the west; its semi-transparent water had a temperature of  $20^{\circ}.3$ , and yet the sun had not shown himself that day and the night had been frosty. Probably the pool is fed by relatively warm springs. At the point where we forded it, its bed was completely sterile, but contained an abundance of the same small Crustaceans that we had already met with in several places before, and which are described in another part of this work.\* Between the pool and the lake the ground is for the most part barren, being clothed with only a thin sprinkling of moss. Otherwise it is strewn with gravel, and was often marshy.

The western shore of this lake is more irregular than usual, being diversified by a couple of long capes, several small islands, and one large island of a curious annular form, and only just rising above the water. Strange to say this lake, notwithstanding that it seems to mark a low depression in a fresh latitudinal valley, is not entered by any main stream from the west. Instead of that it is joined by several small rivulets from that direction. Probably the reason is that the country west of the lake does not possess an evenly distributed slope towards the east, but is on the whole horizontal, and is divided up into a mosaic of small basins, each containing a pool of the same kind as those which we had just left behind us.

Grass began to make its appearance again on the hills of the western shore, and between the south-western corner of the lake and an elongated pool the grazing

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\* See vol. VI, pt. I, *Zoologie*, by Prof. W. Leche, p. 67.



*Ljust A. B. Lagredius & Westphal.*

THE SALT LAKE OF CAMP XXXV.







*Lystr. A. B. Langsdorf & Westphal.*

SOUTHERN PART OF THE SALT LAKE OF CAMP XXXV.



was even good. This pool is entered by a freshwater stream, whereas the water in the lake is salt. The reading of the areometer was however only 1.021; the salinity was therefore merely a trifle as compared with that in the large salt lake described in the last chapter. The reason of the difference between these two neighbouring lakes, both of them situated in self-contained drainage-basins, may be that, while the former is actually and absolutely a terminal basin, the bottom of which is impermeably cemented with concentrated salt, and the only way the lake is able to discharge a single drop of water is through evaporation, the salt lake at Camp XXXV (alt. 4854 m.) gets rid of its water, partly by evaporation, partly by means of a subterranean emissary. But since the amount which evaporates is greater than that which finds its way out through the emissary, the water that remains must in process of time assume, however slightly, a trace of salinity.



Fig. 89. CAMP XXXV AND SHORE REGION ON THE SALT-LAKE.

Only once did we come across hard rock, and that was immediately south of Camp XXXIV, namely a reddish grey sandstone, soft, powdery, and greatly weathered, dipping at an angle of  $82^{\circ}$  towards the S.  $15^{\circ}$  E. I should have hesitated to call it 'hard' rock at all, were it not that all the country round about was edged in and seamed with very low ridges and swellings, all parallel to one another. Beyond that we only saw loose blocks and gravelly débris, partly of a conglomerate, partly of a hard, finely crystalline, blue-black variety of rock. Otherwise the country consists entirely of finely comminuted material.

August 28th. For a short distance we followed the western and southern shores of the lake, close to which stand small detached hills, thinly clothed with grass. In the narrow belt between them and the water-line stretches a chain of elongated lagoons, divided from the lake by merely a braiding of mud, about a meter across. These basins are excessively shallow, and barren, the water in them being slightly saline. The next ridge rises along the southern shore, but it is really nothing but a series of flattened hills. These, which consist solely of coarse sand and fine smooth gravel, are covered with a thin sprinkling of grass and moss. Upon reaching a large collection of quite small pools we turned away from the lake and travelled along the western side of a large pool, which stretches towards the south-east. In fact the pool ought perhaps to be regarded as a part of the lake itself, seeing that it is only separated from it by a low strip of mud. The pool or bay is very shallow; and so too is the entire lake, at any rate the greater part of it, for its colour is light green, an indication that the bottom is not very far down. On the west side of the pool there are again low sandy hills, more or less detached and with an abundance of grass. Immediately south of this pool came a number of others, all small, situated only about one or two meters above the level of the lake and entered by tiny rivulets; in these the water was perfectly fresh. Their immediate environs are furrowed by a great number of watercourses, which however only carry water after rain. Here in consequence of the vegetation the ground is firmer, and the greater portion of the rainfall runs away on the surface.



Fig. 90. Right. 0.36 0.73 1.22 1.59 0.87 0.40 0.40 0.74 1.67 0.58 = depth. Left.  
 1 93 121 132 100 92 91 115 111 2 }  
 97 136 156 80 80 82 100 122 1 } velocity.  
 127 167 137  
 Breadth = 39.3. Camp XXXVI, Aug. 26th 1900.

From a stretch of small hills we now saw in the south a perfect labyrinth of watery expanses. First we were forced by a bay to make a detour to the south-west; along its northern shore is a string of small pools, not more than 50 m. long, and extending east and west. Into the bay flowed a brook 16 m. broad and about 1 cub.m. in volume; its current was very muddy, and discoloured all the water in the bay. After that we continued southwards for a time, threading our way among an endless number of pools and across ground that was partly marshy, partly hard gravel, until we were again stopped by a large, reddish muddy stream, flowing into the salt lake, or rather into a broad sound which connects the salt lake with a fresh-water lake immediately to the south of it. This new river at Camp XXXVI (alt. 4847 m.), like the river between Camps XXXII and XXXIII, expands quite close to its mouth into two basins, the lower one being particularly large. The upper basin is full of sand-banks, the water being there able to accomplish its labour of sedimentation in undisturbed tranquillity. The larger basin was stained a reddish brown for a considerable distance out from the bank.

On 29th August I measured the river at the narrow passage between the two basins. Its bottom consisted in part of soft mud, which refused to bear, in part of hard gravel, this last chiefly under the left bank. At 1 p.m. the water had a temperature of 9.°6. The breadth was 39.8 m.; the mean depth, 0.787 m.; the mean velocity, 0.986 m.; and the volume, 30.9 cub.m. in the second. Thus this river too is of unusual dimensions, though it was evidently at that time swollen in consequence of the heavy fall of hail and snow which took place on the day preceding. It was by no means easy to ford; at the point where I measured it the depth amounted to 1.69 m., and accordingly it was there unfordable; but we managed to get across a little higher up between the sand-banks.



Fig. 91. AT CAMP XXXVI.

In the lower basin the water was quite fresh, so that the salt lake does not penetrate up as far as that. Here we perceived vast numbers of wild-duck and wild-geese. The basin is surrounded by two peninsulas of peculiar shape: the northern one forms a long narrow cape projecting eastwards, and north of it lies the bay which I have mentioned before. North of the bay is a more blunted peninsula, also pointing east and rising into hills. This is the peninsula over the root of which we crossed, and which parted us from the salt lake. In the lower basin, which approaches 2 m. in depth, the current almost entirely ceases, but it becomes distinctly perceptible again in the narrow passage that conveys the river-water to the sound between the two lakes. After fording the last-named, which generally is shallow and contains some small islands, we ascended, on the opposite mainland, a small height, from which we obtained a general view of this highly intricate locality, a locality in which water is more abundant than land, so that it would be impossible to explore it without a boat. When on the top of the height in question we were surrounded on three sides by water, some of the sheets being really of considerable extent.

Northwards, immediately under our feet, lay the broad expanse of the salt lake, while the new freshwater lake stretched a long way to the east. Between the two is a long, narrow strip of land traversed by a couple of ridges. At the foot of these, that is to say on the northern shore of the freshwater lake, the grazing was wonderfully good, and there was any quantity of game. For instance, there were kulans and wild yaks, large numbers of hares, and in the distance we saw a fox, and at night heard the wolves howling, while wild-duck and wild-geese swarmed all round the shores of the lake. A small caravan might support itself here for some weeks; nor did I neglect the opportunity, for while the camels were given a rest at Camp XXXVI, I made a little excursion to see what this lake region was like.

Our outlook hill stood on a peculiar, fantastically shaped peninsula, the outlines of which we only thoroughly understood after another excursion. To the south was a bay of the freshwater lake, and beyond it a sort of long, narrow natural pier, low-lying and somewhat curving, that terminates in an island. Then, very nearly parallel with the shore of the bay, are two semicircular flattened ramparts or ridges of very regular formation, and consisting of gravel and coarse sand tightly packed together. On the western shore of the peninsula again there are two similar ramparts at exactly the same elevation above the water as the first two, but in themselves both lower and smaller. Ensconced between the first pair of ramparts are five elongated pools, the water in which was perfectly fresh; they lay about 2 m. above the level of the lake. The western pair of ramparts likewise embrace two elongated pools, both of pretty large size. Inside each of the inner ramparts there is a large shallow sheet of water. On the peninsula again there are several other pools, though these are in no way connected with the ramparts.

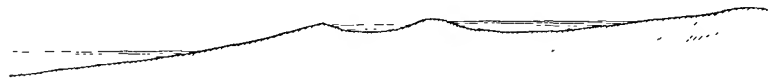


Fig. 92.

That these ramparts mark older beach-lines (fig. 92) of the lake admits of no doubt, so that the lake is obviously shrinking. In both cases alike the rampart next the lake is lower than the outer one, which was formed when the lake rose to a higher level. The narrow depression between each pair of ramparts is especially suited to serve as a reservoir, and its bottom must be cemented with fine mud and clay, which does not allow the water that gathers in it after rain, or that from small springs, to percolate into the ground and so escape. As for the lake itself, it lies due south of the salt lake, and the water it contains is perfectly fresh and tolerably limpid, and after having received the river, with its 30 cub.m. in the second, it empties itself into the salt lake through the sound already alluded to.

On August 30th we started on the little reconnoitring excursion. After crossing the mouth of the river, a matter of some difficulty even with the help of the boat, we steered towards the east-south-east, across the narrow »stalk« of the peculiarly shaped peninsula, having water on both sides of us, on the left the lower basin of the river and on the right a bay of the freshwater lake, entirely filled with islands,

peninsulas, and mud deposits. Immediately above the place where we forded it the river divides into two arms, and of these the arm on the right enters the bay just named. Its bed, which is choked with extensive alluvial deposits of a reddish brown colour, contained only a few small sheets of water, though there were indications that it had recently conveyed a flood of noteworthy dimensions. After heavy rains this watercourse will probably carry 50 to 60 cub.m. or more in the second. And when this right arm contains water, the peninsula on which we then were becomes converted into an island, which is likewise studded with a number of tiny pools.



Fig. 93. VERTICAL SECTION OF ISTHMUS.

The caravan now crossed over the sound between the two lakes at its narrowest part, being helped by the boat. The breadth there amounted to 62 m., the maximum depth being  $3\frac{1}{2}$  m. The bottom consisted of soft mud. North-east of the sound are several flat, grass-grown mud islands, and these are separated from our large peninsula by a stretch of water only 2 to 3 dm. deep and covering a hard bottom that bore; but the sound between its eastern end and the opposite peninsula was 2 to 3 m. deep. Owing to a stiff westerly gale and the waves on the lake, there was scarce any perceptible current in the sound; yet there was a current, because not only was the water perfectly fresh, and consequently must have come from the freshwater lake, but we found it to be so when we measured it on a later occasion.

The right or east bank of the sound is formed by a small secondary peninsula projecting from the larger one, which we had previously examined. Its »stalk» is however so low and so narrow that a very slight rise of the water-level would suffice to convert it also into an island. Then we threaded our way through a number of pools and between two low hills towards the north-east, to the outlook hill which I have already mentioned, then between it and the rounded bay, and then followed the shore of the freshwater lake to the east, having quite close on our left hand the ridge which forms the backbone of the narrow tongue of land separating the two lakes. Both the shore and the slopes of the hills adjacent, on which the grazing was in general good, are braided by regular tracks made by the kulans and wild yaks. Of the latter we saw eleven big black animals at the place where we subsequently encamped. The shore-line here is very ragged and broken, and lined by numerous small lagoons, merely separated from the lake by low, narrow spits of sand. These lagoons are fed by small rivulets from the mountains or by springs which gush out at their foot. Their waters literally swarmed with wild-geese. The lower slopes of the mountains were frequently marshy and water-logged.

Soon however this flat strip of shore came to an end, for the mountain-range approaches close to the lake, its craggy walls plunging in many places sheer into the water; indeed in some places they actually overhang it (fig. 93). Upon coming to the



first of these places we had no choice except to climb up over the top of the mountains, which are not more than 50 m. in relative altitude. Then for a considerable distance the freshwater lake was hidden from us by the crest of the range. In two or three places the water-divide between the two lakes thus lay on the south of our route, while on the north a little brook flows down a broad cauldron-shaped valley with good grass. This brook enters the salt lake, the only lake within sight from that point, namely the point where the strip of land between the two lakes is the narrowest. Alongside the salt-lake there is also a ridge, but it is flatter and more rounded, and does not consist of hard rock. Between the two ridges lie a couple of small self-contained basins embracing pools.



Fig. 94. CAMP XXXVII.

We made our way down to the shore of the freshwater lake over a very low swelling or divide, the slope being scored by tiny rivulets, and the lake beset by a number of lagoons. Beside one of these rivulets we made Camp XXXVII, there being any quantity of yak-dung for fuel.

The little range consists of a hard close-grained rock with an undecided dip — it appeared to be  $13^{\circ}$  towards the N.  $30^{\circ}$  W., though the faces of the strata cropped out towards the south, so that just in that place the range is very steep. It has however a long slope towards the north. As the southern shore of the lake is bordered by a leveller, undulating country, the inference suggests itself, that the greatest depth will be found in its northern part.

August 31st. Continuing towards the east, we had to keep half a kilometer away from the shore, on the lower slopes of the hills, for the strip next the water was marshy and boggy. On the way we passed a number of small water-channels, all of which, strange to say, contained water, although they only had their origins in the low rounded range on our left. The shore-line is all along indented by an

endless string of lagoons. Here and there are small islets, or long and extremely narrow spits of land lying parallel with the shore. In the S.  $68^{\circ}$  W. rose a gigantic snowy mass; in the S.  $14^{\circ}$  E. a similar smaller mass. Both were a very long way from the southern shore of the lake, but as the sky was clear and free from clouds, they both stood out sharply and distinctly.

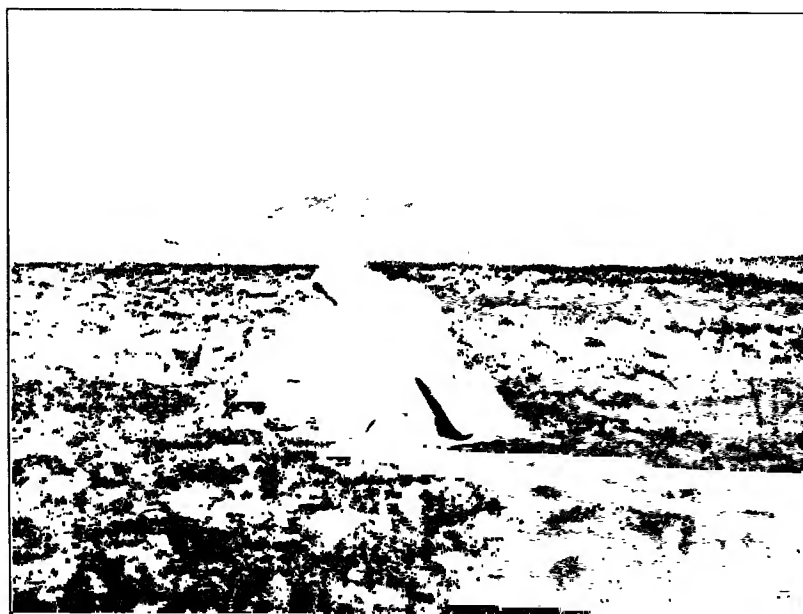


Fig. 95. THE SAME.

Finally, swinging round in a wide curve to the south, the lake comes to an end. At the same time the ridge which we had hitherto had on our left likewise swings round with it, but then continues on towards the east along the northern side of another lake, which again contains fresh water, although it was then exceptionally muddy, its transparency not exceeding 10 to 12 cm. The isthmus between the two lakes is at its narrowest not more than a couple of hundred meters across, and very low. The ridge consists almost entirely of soft disintegrated material and descends by a long, gentle slope towards the shore, leaving an almost level strip close to the water's edge. This lake too is joined by a countless number of tiny rivulets, some of which have cut pretty deep beds for themselves, though they are however generally marshy and boggy. For a considerable distance we crossed one of these deep torrents at every 200 meters. In the lake lies a crescentic island, the horns pointing towards the east. In the south-east of the lake, close to the southern shore, there appeared to be a second island, though possibly it is a peninsula.

Where the first-mentioned island occurs, the lake is contracted, and from that point the opposite or northern shore assumes the most fantastic and peculiar outline. It is cut by a number of brooks, the lowest parts of which run for considerable distances parallel with the shore before they finally turn and enter the lake, being separated from it in the meantime by steep, grass-grown hills of yellow earth, 4 to 5 m. high (fig. 96). Across the delta of each brook there is further a similar rampart, very

sharply outlined, and the consequence is that the brook empties into a lagoon, to which the rampart serves as a dam. But as these ramparts only occur where the brooks enter the lake, it is pretty evident that they are connected with the capacity which each little stream possesses of depositing sediment (see fig. 97). The deltaic formation is here excessively common; it is seldom that a brook falls directly into the lake, without first traversing a lagoon. Pools exist also at a pretty considerable distance from the shore and at an altitude of several meters above the surface of the lake; they owe their origin to natural springs, which gush out at the bases of the hills, making conchoid hollows in the ground where they emerge. These, when they reach leveller ground, make it marshy and boggy. Some of these torrents have scooped out such deep beds for themselves that we were obliged to make detours round them, although they were frequently only one meter across.

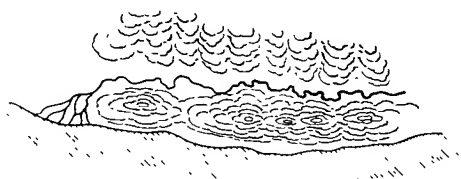


Fig. 96.

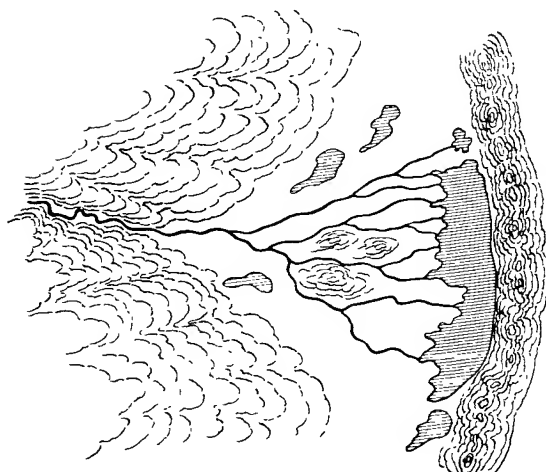


Fig. 97.

From this point the northern shore shoots away towards the north-east in almost a straight line, for this freshwater lake proved to be of very great extent. Then for a space the ridge recedes farther from the lake, the shore being pretty level. Here we had a fresh type of shore formation, in that on the inner side of an exceedingly flat and scarce noticeable rampart the countless little torrents give rise to a long strip of intermittent marsh, containing pools. At the points where they enter the marsh the several brooks split up into a great number of deltaic arms. But the lake being the ultimate destination of the water, this latter every now and again cuts its way through the rampart, forming a fresh delta on the lake side of the rampart. Thus several of these torrents possess the peculiar property of forming each two deltas (fig. 99). Generally the ground is marshy and boggy, and the

only line along which we were able to march with comfort was the flat ridge.

Then the ridge once more approaches the shore, and even at one spot goes steeply down into the lake, so that we had perforce to climb up to its crest, which is probably 60 to 70 m. above the level of the lake. Over on the other side we made Camp XXXVIII, as usual beside a shore lagoon containing fresh water. Our camp was about 10 m. above the lake, the surface of which has an absolute altitude of 4847 m. The water in the eastern end of the lake was tolerably clear and contained an abundance of fish. The other representatives of the fauna were wild yaks and kulans, hares, marmots, and «earth-rats». We also saw bears on several occasions, and many of the marmots' burrows had been scratched out by bears in quest of the animals within. Here too there was a species of lizard that is very common



CAMP XXXVII ON THE SHORE OF THE WESTERN FRESHWATER LAKE.



*Ljustr. A. B. Lagelius & Westphal.*

CAMP XXXVIII ON THE SHORE OF THE EASTERN FRESHWATER LAKE.





CAMP XLVII. 5263 M. HIGH.

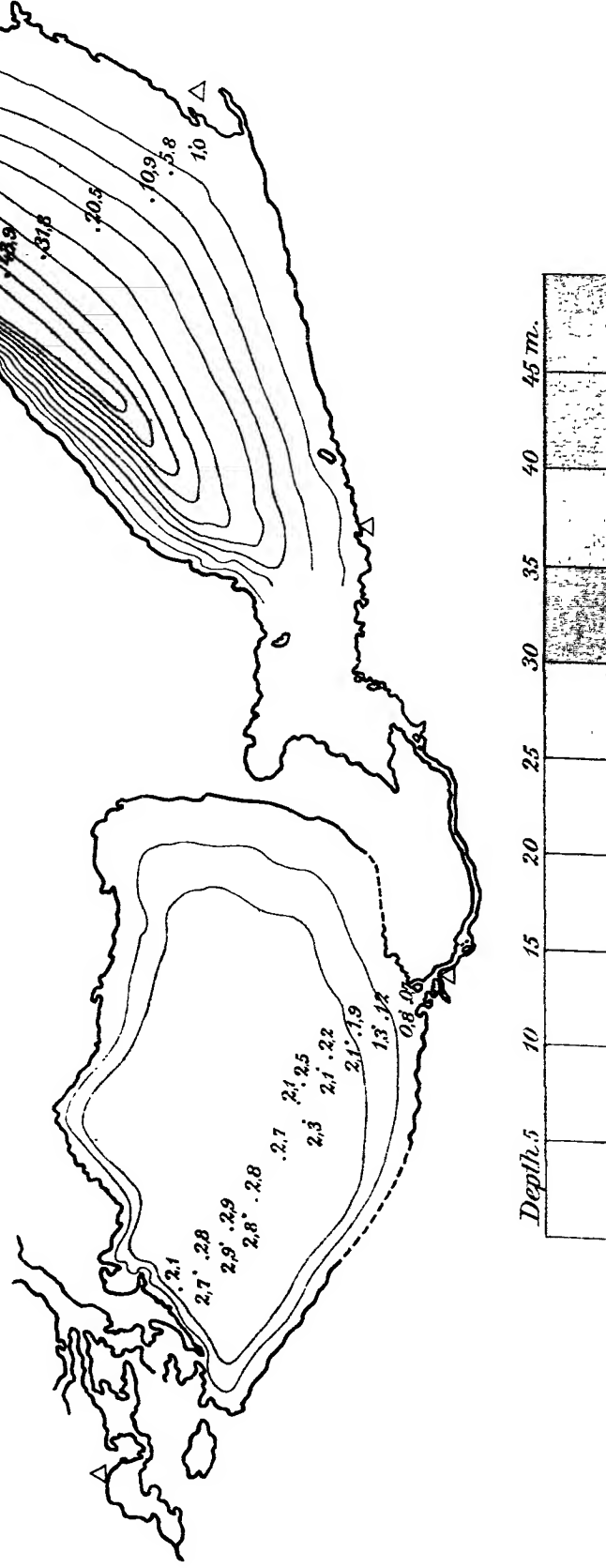
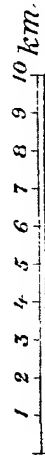


*Ljustr A B Lagretius & Westphal.*

THE EASTERN FRESHWATER LAKE



**SCALE 1:200000**







in Tibet. And the weather was so mild that we also saw flies and humble-bees, and even a few midges.

At one point on the shore of the western lake there crops out a small portion of hard rock, consisting of a green, coarsely crystalline variety dipping  $70^{\circ}$  E., greatly weathered and surrounded by gravel of black argillaceous schists. On the isthmus between the two lakes the same rock dips  $56^{\circ}$  towards the S.  $35^{\circ}$  W. Farther on beside the eastern lake there is a smaller outcrop of a hard violet-black variety of rock. The steep mountain-walls near the camp (see Pl. 22) consisted of red conglomerate, dipping  $80^{\circ}$  towards the S.  $30^{\circ}$  E. With these exceptions all the mountains and ridges in this neighbourhood consist of friable, disintegrated matter. O' indicates our isolated, dominating mountain-group, which had been within sight during the last two days; from this camp its direction was S.  $33^{\circ}$  E.

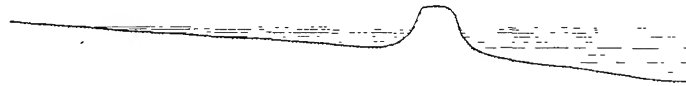


Fig. 98.

The nearest summit west of our camp afforded an excellent view of the surroundings. We saw how the lake narrows towards the north and terminates in a rounded bay, probably pretty shallow. Beyond that, and also forming its northern continuation, lies a large pool, completely cut off and fed by streams from the circumjacent heights. A low isthmus parts it from the lake. The ridge which runs round the north-western corner of the lake appeared to continue beyond the pool, and had a red tinge. From the heights north-west and west-north-west of our outlook the rivulets gather into a large brook, which enters a small bay cutting into a blunted sedimentary peninsula, with a couple of lagoons. On the opposite or eastern shore there is a very long and broken rampart of sediment. Some kilometers to the N.  $80^{\circ}$  W. we saw the blue gleam of a sheet of water; this must have been the salt lake beside which we made Camp XXXV.

On the 1st September the caravan doubled the northern end of the lake. In that direction it contracts to a sharp, narrow bay, and is joined by several small brooks, though by no large ones. The ground was everywhere firm, the grazing good, and the usual fuel abundant. Taking the little skiff, I myself paid a visit to the cliffs that in places overhang the lake, and some of the impending pieces looked as if they might come crashing down at any moment. The upper part of the cliff-wall consists of red conglomerate, the base of red sandstone, dipping  $72^{\circ}$  towards the S.  $85^{\circ}$  E. All the mountains in the immediate vicinity appeared to consist of the same varieties of rock. Close in shore the lake was  $1\frac{1}{2}$  to 2 m. deep; and the abrasion terrace, which is littered with gravel and large blocks of stone, is 50 to 75 m. broad.

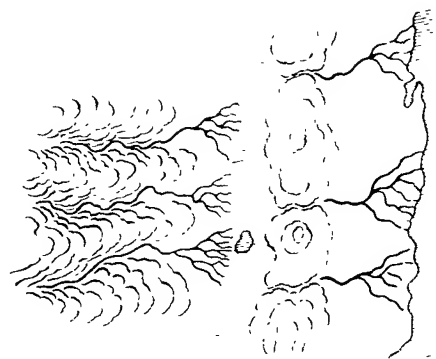


Fig. 99.

We took a line of soundings diagonally across the lake, that is towards the south-east, traversing it at its broadest part, 9.4 km. The maximum sounding along this line is probably the deepest place in the lake as a whole. Our soundings were 14.82, 48.67, 43.90, 31.77, 20.53, 10.90, 5.87, and 1.93 m. As might be expected from the indications of the modelling of the adjacent country, the greatest depth thus lies under the northern shore. In fact, the sounding of 48.67 m. is the deepest I obtained in any Tibetan lake, although two or three others approached pretty close to it. During the trip a furious storm blew from the north-west, accompanied by hail of extraordinary violence. In such a tempest the waves reach a not inconsiderable height, at any rate high enough to make it perilous to be out amongst them in a fragile canvas skiff. But no sooner did the storm cease than the lake, owing to its small area, rapidly grew calm again. From its deepest part it shelves gradually up towards the southern shore, and at the point where we landed it was pretty shallow, the depth amounting to only 0.15 m. at a distance of 10 m. from the edge of the water. A lagoon there, which is protected by a long narrow rampart, was however 1 m. deep. Within the rampart are several other shallower lagoons. The accompanying sketches will show the difference between the northern shore at Camp XXXVIII (fig. 100) and the southern shore at Camp XXXIX (fig. 101).



Fig. 100. VERTICAL SECTION NEAR CAMP XXXVIII.



Fig. 101. THE RAMPART BETWEEN THE LAKE AND A LAGOON.

September 2nd. The lake terminated near the spot where we were encamped, and the southern shore-line, after making a long loop full of lagoons, ramparts, and marginal pools, curves round to the west and so ends this relatively deep freshwater depression. Close to the camp we crossed over two or three small dry watercourses, which enter quite a small bay. Beyond them the surface assumes a peculiar form, difficult to travel over; it is soft and well grassed, but dotted all over with pit-like pools, containing fresh but slightly muddy water; the pits are distinctly marked, their sides being often vertical. They are in general little more than 50 m. in diameter. The ground itself assumes very curious outlines, forming cubes, terraces, ramparts, and pits, the result no doubt of springs and infiltrating water.

Upon crossing over a brook, we found the ground on the south side of it disagreeably boggy, as full of water as a sponge, and it continued so for practically the rest of the day. On the whole however the ground was level, and undulated in only the slightest degree; in fact it was mostly impossible to tell in which direction it sloped. Hence it is easy to understand the indecision of the surface water, and why, instead of running off in brooks and streams, it gathers into pools. These we

saw glancing like mirrors by the hundred in whichever direction we looked. It is only exceptionally that two of them are connected together by means of a tiny sound or a hollow with treacherous boggy ground. Round the pools that are not steep-sided, the ground is excessively marshy, and we took very good care not to approach too close to them. This flat country stretches between two main ranges of mountains, namely on the north that which runs along the north side of the two freshwater lakes, and appears to be continued east by some tolerably low, rounded heights. The southern range, so far as we were able to see, likewise consists of rounded heights. Amongst its first foot-hills are an innumerable quantity of small pools, with beautifully clear water,  $1\frac{1}{2}$  m. deep, and fed by springs; each was surrounded by a carpet of luscious green grass. On the south of them is a depression containing some larger pools. From the eastern end of the largest of these, an oblong sheet of water, issues a small brook, flowing in a deep, narrow bed, and emptying itself into a smaller pool in the neighbourhood. Here again marshes and sheets of water abound in every direction. The country that we traversed during the rest of the day consisted of a chaos of pools, hills, and small brooks. We formed Camp XL (alt. 4920 m.) beside one of the larger brooks, which, after traversing several pools, falls into a lake that we saw to the north-east. This brook contained fish fry of the same species as that in the freshwater lakes.

From that point the slopes of the mountains run up to the main range that I have mentioned. The latitudinal valley which stretches between this range and its northern *vis-à-vis* is unlike those we have already dealt with. For one thing it is considerably broader, forming in fact a gigantic *mulde*-like expansion. The strike of the northern range is not so strictly due east and west as that of the preceding ranges, but it makes an elbow pointing north, into which the eastern lake thrusts its north-going bay. Here too all the mountains are red; more particularly is this true of the great isolated group O', which was mantled with some smaller snow-fields. We only saw hard rock in a single place, namely on the northern shore of the largest pool, where the red sandstone cropped out at  $27^{\circ}$  to the N.  $35^{\circ}$  E. Gravelly *débris* of the same rock was quite common all day, especially in the vicinity of the hills.

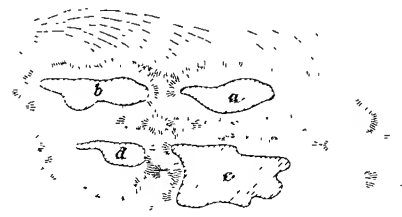


Fig. 102.

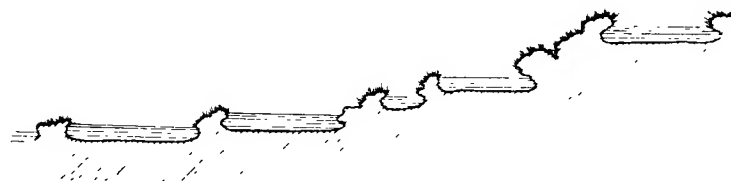


Fig. 103.

The distinguishing characteristics of this entire region are the extraordinary abundance of water, and the fact that it forms, not running brooks, but stationary expanses or sheets. Very often these are arranged in chains or rows, and are connected together either on the surface or by underground communications. It must not

be supposed however, that they all lie at anything like the same level; in fact their differences of elevation are generally obvious enough at a glance. In fig. 102, for instance, which represents four contiguous pools, *c* lies at least 1 m. higher than *a*, while *b* and *d* stand at intermediate levels. Yet the distance between *c* and *a* is only 5 m. These relations are especially noticeable in the spring-fed pools amongst the foothills. There they occur (see fig. 103) on successive steps, the water frequently dropping or running in a thin trickle from one miniature basin to the next below it.

On the 3rd September we started to return to the southern shore of the eastern lake, leaving the large pools on our right and keeping closer to the mountains, from which numerous small rivulets issue, while springs gush out in countless quantities. These northern slopes again are excessively soft and marshy: the horses sank in some 60 cm. as compared with 20 to 30 cm. elsewhere, and often enough had much ado to draw their feet out of the tough, tenacious clayey mire.

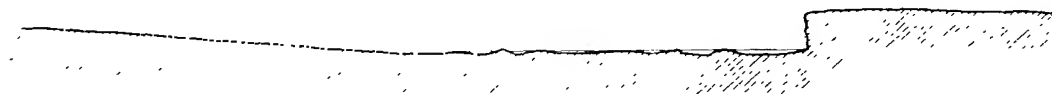
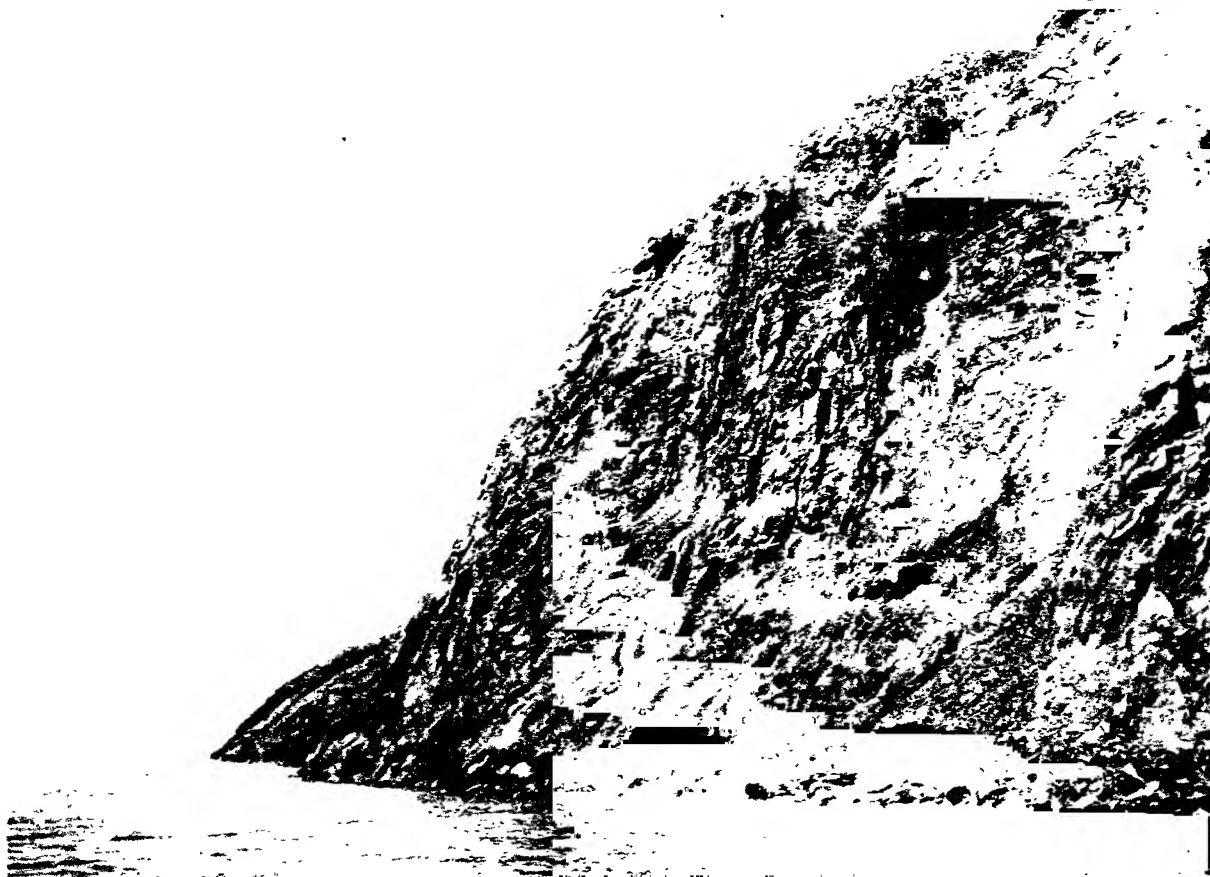


Fig. 104.

After fording a larger brook that issues from a glen, we approached a true river flowing due north. This we accordingly followed all the way to the lake, its gravelly bottom being hard enough to bear us. Its volume may have amounted to 10 to 15 cub.m., and strange to say the water was throughout perfectly clear, as though it were derived entirely from springs or had passed through a clearing-basin. Nevertheless there were plain indications, that rain-water also collects into it sometimes and that the river then swells very considerably. At this time however the flood was divided into several winding arms, bordered on the right by a distinctly eroded terrace, 3 m. high, which appeared to continue all the way down to the neighbourhood of the lake (fig. 104). On the left however there is no terraced bank, but the ground slopes gently down to the actual bed of the stream. Vegetation was scanty, mostly thin moss, grass occurring but seldom in the vicinity of the river. On both sides the ground consisted of coarse sand intermingled with gravel, resting on a base of yellowish-red argillaceous sand, heavily charged with water. It was very seldom that this ground was firm enough to bear us comfortably; it was generally marshy and difficult to ride over.

The country abounded in game. We saw six or seven herds of orongo antelopes, each numbering about 20 individuals. Kulans, either singly or in small troops, were in sight all day. Further, we observed one or two wild yaks, besides marmots, earth-rats, and signs of bears and wolves.

It snowed and hailed all day without intermission, to the accompaniment of thunder and lightning. But the ground was so warm that the snow and hail all melted as it fell. After a bright night, we had good weather, and a clear sky the following day, with a stiff wind from the north-north-west, which spoiled a lake



THE SHORE A LITTLE TO THE WEST OF CAMP XXXVIII.



*Ljustr. A. B. Lagrelius & Westphal.*

THE SAME AS SEEN SOME DISTANCE FROM SHORE.



excursion that I had planned. The winds out of the north quarters are probably the driest; and yet on 1st September, during a similar north-north-west gale, we were visited by a leaden black hail-storm that came out of the west.

Around our camp were some pools and hills. The shore-line along which we marched on the 4th September, though at a little distance away from it, was excessively jagged and irregular, forming capes, peninsulas, bays, islands, holms, lagoons, and pools, all in miniature. The surface sinks down imperceptibly towards the lake, which is so shallow in its southern part that a long way out the water is coloured a brownish red by the beat of the waves, whereas towards the north it shone blue-green and limpid. Throughout the whole length of the lake the greatest depths undoubtedly occur close to the northern, or rather the north-western, shore.

The ground alongside the lake was horrible, one unbroken morass of soft ooze. In these high altitudes the earth appears to be attenuated like the air. At length we approached the western end of the lake, which is divided into three bays by two stretches of hills. The northern bay we have already made acquaintance with; the middle one appeared to be the largest; the southern bay is entered by the river that connects the eastern with the western lake. This connecting sound is short and almost straight, and full of shallows and mud islands, and appeared to be fordable in several places. Its water was muddier than I had expected to find it, seeing that it issues direct from a clearing-basin. Wild-geese swarmed in flocks of hundreds together and wild-duck were plentiful everywhere, while we also saw an occasional crow, royal eagle, and gull. On the right side of the sound rises one of the spurs of low hills, while the left side is flat and seamed with a countless number of torrents, some with water, others dry, and all surrounded with pools, which appear to be connected, at all events sometimes, with the sound, for two or three of them contained fish. Yet it is probable that what we from our low-lying position took to be separate brooks are in reality only deltaic arms, into which the brooks and streams off the southern mountains divide upon reaching the flat land. Here too the ground consisted entirely of wet mud, brought down from the mountains by the streams. Sometimes this soft ground literally swayed underfoot, and undulated like waves beneath the weight of the caravan.

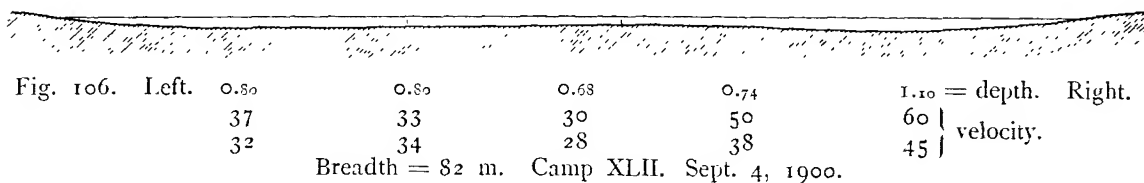
At the spot where we made Camp XLII the sound measured 82 m. in breadth, 0.687 m. in mean depth, 0.353 m. in mean velocity, and had a volume of 19.9 cub.m., or in round numbers 20 cub.m. in the second. By far the greatest portion of this volume is contributed by the river that we followed down to the lake; at the point where we forded it, it had an estimated volume of 10 to 15 cub.m. The residue is derived from the innumerable rivulets which flow into it from every quarter. But probably a part of the flood of the principal river is lost before it reaches the lake. For some distance before coming to Camp XLI we marched a little way back from the river; but I have no doubt, that, like the brooks which enter the emissary of the lake, it divides into a number of deltaic arms and pools, the consequence being to enlarge the evaporation area. If the river carries 12 cub.m. when it emerges from the lowest foot-hills, it is fair to assume that not more than 10 cub.m. fall directly into the lake, so that 2 cub.m. are consumed in filling the pools and maintaining the ground in a moist condition.





Fig. 105. VIEW OF THE RIVER BELOW CAMP XXVIII.

We had thus made the circuit of the eastern regions of this extraordinarily complicated self-contained basin, and ascertained that the greater part of the surface water finds its way into the eastern freshwater lake, and thence proceeds into the western freshwater lake, which I will now proceed to describe. The eastern lake lies close under the mountains that fence it in on the north. To judge from the great volume of the river that flows into this lake from the south, the distance to the crest or divide on the mountains that bound the basin on the south must be pretty



considerable. But to the south of the south-east corner of the lake we found a very flat water-divide, from which a brook flows down to a smaller lake in the north-east. This notwithstanding, all the pools here — and their number must certainly run into several thousands — form each its own little self-contained basin. The shape of the entire eastern basin is faithfully reflected in the shape and bathymetrical relations of the lake itself. Were the level of the lake to be raised some 50 m., the lake would still preserve on the whole the same shape that it exhibits now, although it would be several times larger.

## CHAPTER IX.

### A DETOUR ROUND THE GREAT GLACIATED MOUNTAIN.

September 5th. Immediately below our camp the river was entered by a pretty broad stream, which however was shallow, and had an extremely sluggish flow. After that the river widens out into a funnel-like estuary, beset with numerous islets and mud-banks, overgrown with grass. Upon emerging from the estuary, we

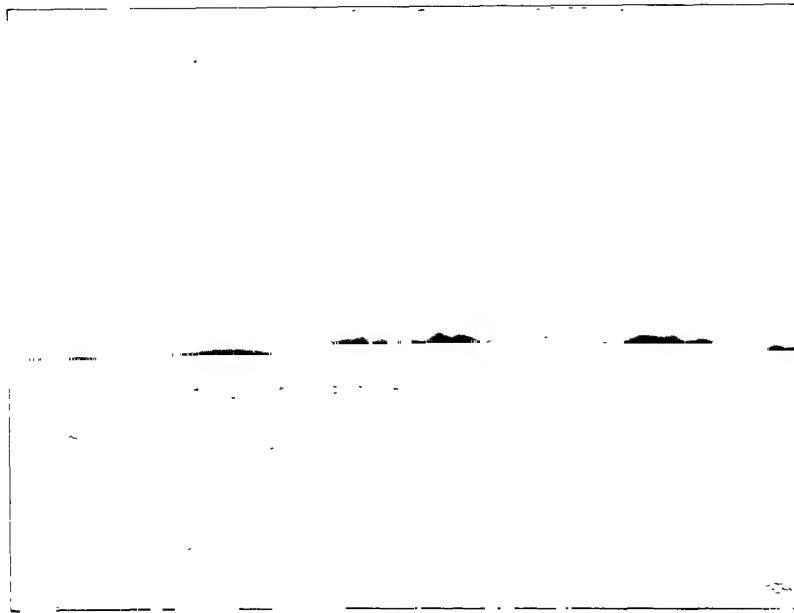


Fig. 107. THE WESTERN FRESHWATER LAKE.

had the broadest part of the lake on our right, that is the north. The excursion which I now made across it towards the west-north-west was carried out under very unfavourable conditions; but the course we followed was in general nearer to the southern shore than to the northern, and consequently the depth was but slight, nowhere as much as 3 m. Owing to the extraordinary flatness of the southern shore, we were scarce able to see it; the opposite or northern shore, on the con-

trary, stood out boldly and distinctly, especially so long as the ridge behind it was strongly illumined by the sun. It was my intention to take a series of soundings diagonally across the lake; but in this I was disappointed. Nevertheless it may pretty safely be taken, that this lake, like its neighbour to the east, is deepest towards the north, where the mountains plunge steeply down into its water; though probably even there the depth does not exceed 15 to 20 m., if we may judge by the colour of the water. All along the southern shore the water was thick and muddy, and of a reddish brown colour, though this did, it is true, shade away towards the north. All the same there was no room here for the same beautiful blue-green limpidity that we observed in the eastern lake. This discoloration of the water is of course caused partly by the muddy brooks which enter the lake, especially from the south, partly, and probably to the greatest extent, by the stormy weather of the last few days; for this lake, being, like most of those in Tibet, drawn out in the path of the prevailing winds, has its surface broken into waves that reach down to the bottom, at all events over by far the greatest part of its area.

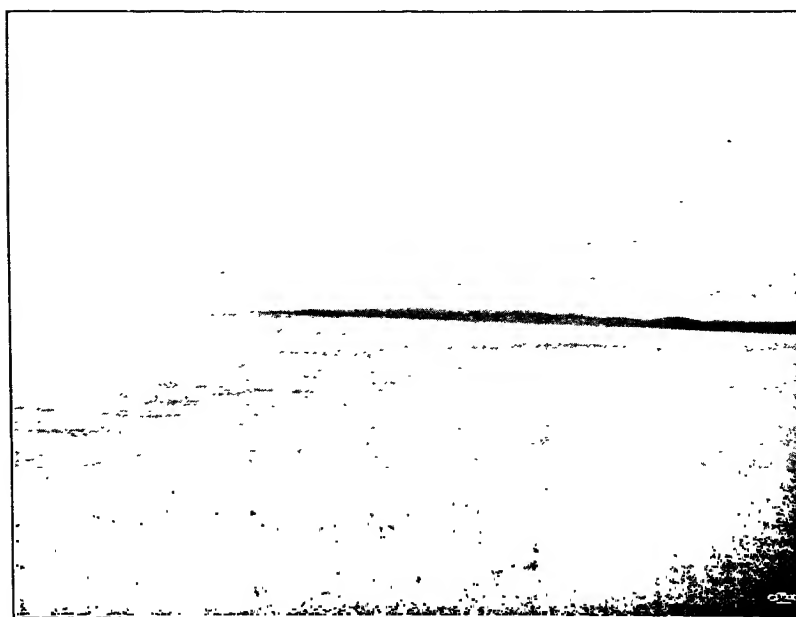


Fig. 108. THE SAME.

The soundings I took run from east to west: — 0.71, 0.76, 1.25, 1.28, 1.90, 2.14, 2.07, 2.18, 2.11, 2.50, 2.13, 2.26, 2.67, 2.85, 2.79, 2.92, 2.92, 2.85, 2.78, and 2.12 quite close to the eastern shore of the peninsula, from one of the heights on which we caught our first glimpse of the lake. Thus in general the depth increases towards the west, though the reason of this is that we proceeded slowly northwards from the southern and shallower part of the lake. Here too the shore of the peninsula was jagged and broken with lagoons and ramparts.

The lake then penetrates between a long, narrow peninsula jutting out towards the south-west and another peninsula projecting from the west, and so continues to the narrow sound which we crossed over on our journey out. West of these two



THE EASTERN FRESHWATER LAKE, LOOKING WEST.



*Ljustr A. B. Lagrelius & Westphal.*

THE SAME LOOKING EAST, BOTH PHOTOS TAKEN FROM THE CANVAS SKIFF.



narrow sounds the shore-line is extremely irregular, being diversified by numbers of bays, peninsulas, capes, and islands.

During the course of this little excursion no less than three westerly storms chased one another across the lake. The first storm-cloud divided just before reaching it, one wing sweeping along the mountains to the south, and leaving upon them a white trail of snow, which however soon disappeared, while the other wing proceeded straight across the lake, driving it up into pretty big waves. The first gust of wind whirled up a cloud of yellow dust on the southern shore, thus demonstrating that there were stretches of dry ground; but the following storms brought with them a heavy rainfall, alternating with slushy snow, which soon damped the dust. And there was even a fourth storm, the most violent of the series, which unfortunately spoiled a measurement of volume that I was making in the narrowest sound. The data I obtained were insufficient, and can only be regarded as approximate. At the same spot the breadth was 62 m.; the mean depth, 1.70 m.; the maximum depth, 3.43 m.; the mean velocity, 0.242 m.; and the volume, 25.5 cub.-m. in the second. The data that were too few, being affected by the waves, were the velocity readings; but in default of anything better the value I have just given must be accepted for what it is worth.

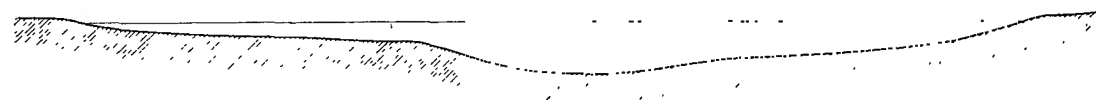


Fig. 109. Right. 0.92      1.12      3.43      2.75      2.0 = depth. Left.  
                  33      28      28      25      20 | velocity.  
                  32  
                  Breadth = 62 m. Sept. 5th.

Recapitulating the results which I obtained in these three lakes — we have ascertained that a volume of 20 cub.m. flows out of the eastern lake into the western, this being the amount of water that the former collects from the whole of its extensive catchment-area. The flood that issues from the western freshwater lake amounts to 25.5 cub.m.; so that the difference of 5.5 cub.m. is derived from the brooks which flow directly into this western lake. The river beside which we made Camp XXXVI enters the sound a short distance below the place where it contracts to its narrowest. This river possessed on the 29th August a volume of 30.9 cub.m., or in round numbers 31 cub.m. in the second, and this has to be added to the 25.5 cub.m. just mentioned. Hence no less than 56 cub.m. flow through the broad sound, which unfortunately was too broad to admit of a trustworthy controlling measurement being made, and these 56 cub.m. enter the salt lake beside which we formed Camp XXXV. For Tibet this is an enormous flood, equal to the total flood of the lower Tarim in winter. The salt lake between Camps XXX and XXXI has an area of about 110 sq.km., and was the recipient of a volume of 43 cub.m. in the second, — that is independently of any other feeder that may enter it. The salt lake of Camp. XXXV has certainly a far smaller area, and yet received 13 cub.m. more water in the second. In the former case the water is impregnated with salt; in the

latter the percentage of salt is relatively very small. The floor of the northern salt lake consists of an impermeable »saucer« of crystallised salt, so that no water can be lost there except by evaporation; but the bottom of the southern salt lake consists of soft sedimentary matter, in part probably of sandy earth, and is permeable. In no other way can we account for this lake not being bigger than it *de facto* is, seeing that it is the recipient of such an enormous inflow, and that this water is collected over such an extensive area and no doubt holds in solution considerable quantities of salts. But since these salts, which all eventually find their way into the terminal salt lake, do not avail to fill it up, the only alternative is to suppose, as I have done above, that merely a portion of its water is lost by evaporation, and that the rest finds its way out again by a subterranean emissary, and that the percentage of salt which remains in the lake is the residue left over by these two sources of loss.

The differences of level between the three lakes are remarkably small: that between the two freshwater lakes is a shade greater than that between the lower freshwater lake and the salt lake; in the latter case, if one may judge from the extremely sluggish current in the sound, the difference can only amount to a few centimeters. The greatest influx of water is brought by the western river, which rises amongst mountains of considerable altitude, where consequently the rainfall is fairly heavy. But so far as we were able to see, neither this river nor that which enters the eastern freshwater lake has its origin in glaciated mountains. Hence both alike are fed by the natural precipitation, which gathers into them in part directly, in part indirectly through springs. In the more northerly pair of lakes, we have found however, that a considerable quantity of the water which goes to swell the stream running south into the freshwater lake is derived from the melting of glacier arms. It is hardly conceivable that in such a short distance there should be any noteworthy difference in the amount of precipitation, even though in the latter part of the summer, as I afterwards learned, and observed even thus early, the precipitation does increase in eastern and central Tibet from north to south, in such wise that, while on the Astin-tagh it is minimal, in the country immediately north of the Tengri-nor it is very abundant. The difference between the volume of 43 cub.m. contributed to the northern salt lake and the volume of 56 cub.m. which enters the southern salt lake may be purely accidental, and does not necessarily prove that the southern self-contained drainage-basin possesses a more copious precipitation than the northern. The fact is, the rivers that feed the southern lake-complex have their sources at lower absolute altitudes than those of the northern lake-complex, these latter coinciding with the altitude of the snow-line and the faces of the glacier-arms. When therefore the winds that are charged with atmospheric moisture pass over this part of Tibet, their contained moisture condenses upon the border-ranges of the southern basin in the form of rain or snow, which quickly melts; at all events it finds its way directly and by the nearest courses into the lake-complex, while at the same time vast quantities of moisture are arrested and stored up on the great glaciated mass and in its *firn* regions, and consequently only reach the northern freshwater lake gradually and in even distribution, spread over a long period of time. The fact of the southern salt lake receiving just then more

water than the northern salt lake was no doubt due to the heavy rainfall of the preceding few days. A spell of warm, bright weather would undoubtedly result in a very appreciable diminution of the inflow into the southern salt lake; whereas in the northern salt lake the diminution would be less noticeable, seeing that during that same warm spell the glaciers and the snow would be melting at a greatly intensified rate.

It may be assumed, that the southern lake-complex shrinks considerably during the winter, just as the northern lake does. Even the salt lake there freezes, though somewhat later of course than its freshwater neighbours.

September 7th. Camp XLIII was pitched about one km. west-north-west of Camp XXXVI, on the northern edge of a big pool, through which the above-mentioned large river runs. The altitude above sea-level was there 4,865 m. Our march this day was westwards through a relatively narrow latitudinal valley, more irregular in form than usual. Close to our route we had, on our left, a low mountain-ridge, bent round like a bow. On the south of this is the valley through which the river flows, bordered on its farther (southern) bank by a similar chain of low hills. Still farther south rises the mountain-range which forms the southern border of the lake-basin. It is to it that the snowy mass T' belongs, the largest orographical complex at this time within sight. To the north our prospect was shut off by a range of rounded hills and low mountains at a distance of about 2 km. And it was under similar conditions to these that the latitudinal valley appeared to be continued for a long way towards the west. In the part of it that we were then traversing there is only one large stream, which empties itself into a pool; but on the other hand there are a great number of tiny rivulets and miniature brooks, all terminating in pools, of which there is likewise an immense number. Thus the low ridge which I have mentioned above constitutes the boundary between a region on the south which is traversed by a very deeply trenched watercourse and another region on the north which is cut up into a great number of self-contained basins of infinitesimal dimensions. Crossing over this little ridge, we encamped on the left bank of the river (alt. 4,888 m.) beside some small hills. As we advanced westwards the grazing grew worse, though here it was again pretty fair. Here the river was not half as big as it was in the lower part of its course, and moreover it was as clear as crystal, from which it may be inferred that lower down it is joined by some turbid tributary.

About midway in the curving range small fragments of porphyry, of a dark violet colour, cropped up out of the soft ground. On the southern side of the same range red sandstone, excessively weathered, cropped out at  $56^{\circ}$  to the S.  $38^{\circ}$  W. The débris in the bottom of the latitudinal valley consisted all the way of gravel of these two species of rock.

All the mountains in the region, even those that are lowest, were covered with snow.

September 8th. To the S.  $54^{\circ}$  W. was a dominating snow-clad peak, which I intended marching round before we turned our faces towards the north-west on the way back to Temirlik. The volume in the part of the river beside which we were encamped had in the morning shrunk to about 3 cub.m., and its current was divided into two arms. Both the bed of the river and the adjacent banks were



extraordinarily marshy and boggy, and it was only, by exercising the utmost caution that we succeeded in getting the caravan along. As it was very unlikely that the camels would be able to travel in the yet higher regions which we were now about to ascend to, I sent a section of the caravan round by the north of the mountain T'. The river seemed to derive the greater part of its water from the snowy peaks indicated by U' and V'.

The first string of soft hills that we came to had a chain of pools running along each side of it, while on the south was a brook that became contributory to the river. The country was now very open towards the south-west, right away to the bases of the dark foot-hills and offshoots that appeared to surround the great mountain-mass of T' on all sides. Westwards too the country appeared to be pretty flat; nevertheless as we advanced we slowly ascended, the ground being practically barren, with the exception of a sprinkling of moss. On the right we passed some hills and a couple of pools, in which the stream that I have just mentioned takes its origin. To the south-west the plain is bounded by hills, amongst which natural springs are numerous, each forming a small miniature basin, framed in emerald green grass, thick, but very short, and as soft underfoot as an Indian carpet. The only hard rock we met with was here at Camp. XLV (alt. 4,973 m.), namely a dark porphyry, which cropped out in a couple of knolls, exposed on the south. The disintegrated materials of this rock, which were scattered about the vicinity, were of a distinctly lighter colour. Fragments and débris of the usual red sandstone occurred here and there.

Almost all day there was a storm from the west, accompanied at times by blinding snow. In the afternoon the north-east wind alternated with the north-west wind. The night was perfectly still and bright, as indeed it usually is at that season of the year. All the next day the same persistent westerly wind prevailed that had been blowing with few and short interruptions since the 1st September. Indeed in this part of Tibet this would appear to be the most pronounced meteorological characteristic of the autumn and winter.

September 9th. From Camp. XLV we saw several mountain summits, by far the most prominent being T' to the S.  $71^{\circ}$  W.; in the S.  $53^{\circ}$  E. was a flat-topped mountain at a few kilometers' distance; in the south and south-south-west a couple of smaller snowy peaks; to the N.  $59^{\circ}$  W. the peak U'; and to the N.  $32^{\circ}$  W. the peak V'.

The surface rose towards the south-west, the direction in which we were travelling, and soon began to grow more undulating and even hilly. The hills are threaded by a multitude of small rivulets and torrents, which trickle down to a brook that flows north-west to join the river of Camp XLIV. The surface was everywhere wonderfully soft and boggy, a veritable marsh of red earth or clay and gravel, amongst which were a few patches of grass. After that we followed a more distinctly marked glen, until we reached the flat pass at its head, consisting of nothing but mire. This pass is situated in a secondary offshoot, on the south of which a brook flows to the east and probably joins the large river that empties itself into the salt lake. Southwards the country grows more and more broken, the crests rising higher than heretofore and the glens being more deeply trenched. For

a short distance we travelled south-east, in order to get round the worst of the offshoots from what was a veritable mountain of mire. This led us to cross over a great number of small brooks, which run down to a large glen that proceeds to the north, picking up several other pretty big mountain torrents on its way. All



Fig. 110. CAMP XLVI AT AN ALTITUDE OF 5,143 M. HERE A WILD YAK WAS KILLED.

these united streams empty finally into a small pool embedded amongst soft hills. Hence a considerable volume of water flows into this small reservoir, and as the reservoir does not appear to have any visible outlet, it probably possesses a subterranean discharge.

The prevailing rock is red sandstone. This just behind Camp XLV dipped  $22^{\circ}$  towards the S.  $10^{\circ}$  W. In the vicinity of the little pass there was a hard green rock, dipping  $53^{\circ}$  towards the S.  $75^{\circ}$  W., while south of the same pass was a similar, but somewhat darker, variety, dipping  $24^{\circ}$  towards the N.  $30^{\circ}$  E. This makes the slope which goes down to the valley on the south very steep, I mean the valley that runs east.

September 10th. The country around Camp XLVI (alt. 5,143 m.) was practically barren, except for some moss and the short Alpine grass that the wild yak loves; and accordingly wild yaks were very numerous in this region. During the summer they seem to prefer the loftiest mountain solitudes and keep by preference close to the regions of perpetual snow; but in winter they descend to relatively lower regions. We also saw kulans and orongo antelopes; but on the other hand no marmots, the ground being no doubt far too wet for them to make burrows in.

Due west we perceived a flat pass, from which descend two parallel valleys, with brooks, which unite immediately south of Camp XLVI and then enter the pool I have lately named; between them runs a chain of rather flat hills. We followed the left bank of the more northerly stream; it is intersected by several very shallow watercourses with boggy, miry bottoms. On the south of the southern glen is a dark mountain-range, forming a connecting link or bridge between T' and a great snowy mass situated a considerable distance to the south-south-east.

Higher up the surface grew flatter, but was nevertheless more difficult to march over. It consisted partly of fine material, red mire and clay, in which a pool of water oozed up and filled every footprint that our horses made; partly of sharp-edged gravel, scattered over the same miry ground; and partly of fragments of rock of all sizes up to 1 cub. foot, and even 1 cub.m., amongst which it was anything but easy to travel. The actual pass however, although it reaches the immense altitude of 5,426 m. (17,800 feet Eng.), and thus is one of the loftiest altitudes I ever reached in Tibet, is so flat that it was scarcely possible to determine the position of its culminating line. Then the great mountain-mass of T', at all events when seen from the top of the pass, appeared to consist of several peaks or dark, short craggy spurs. Their southern slopes were practically free from snow, there being only a couple of narrow strips high up under their culminating points; but the northern flanks were on the contrary covered with snow throughout. Between these black spurs descend two miniature glacier arms, but the actual ice itself was nowhere visible, owing to the covering of snow. From its lower margin trickled some small brooks. That which issues from the more western glacier arm runs westwards towards a fairly distinct glen, the bottom of which contained an abundance of gravel, though but little water. The pass and its environs, as also this western glen, were perfectly sterile. The valley gradually inclines towards the south-west and south-south-west. At Camp XLVII (alt. 5,263 m.) a few blades of grass made their appearance. Throughout the whole of this region the prevailing rocks are a very close-grained variety, which when struck with the hammer fractures in every direction, and a hard crystalline schist.

September 11th. As the valley ran too much to the south-west, and as the hills on its right side were low, we turned out of it and directed our march towards

the north-west, crossing over various brooks which run down towards the south-west. In that quarter we perceived some high mountains belonging to a vast range, which appeared to stretch away to the south-east and east-south-east. One especially conspicuous feature was a gigantic snowy mass, with several peaks, situated S.  $28^{\circ}$  W. Upon the surface becoming much too broken for us, we turned to the west-south-west, along a hilly ridge, which slopes gently down between two brooks to a large main valley, down which flows a main river towards the west-north-west. From certain small detached hills we now directed our course towards the north-west, keeping along the edge of a brook, which after gathering the rainfall off the hills on the right runs down into the main river. The hills in question are rather low, being the last offshoots from the mountain-mass T', which itself appears to be the extreme north-western outpost of a mountain-range that stretches towards the south-east and is apparently broken more than once. In the region in which we have now arrived, and in that which we shall travel through towards the west and north, the ranges seemed to be less regular than hitherto, the usual east-west direction being altered to a north-west and south-east direction.

Very few of the brooks now contained water, for the temperature, even when at the highest, was only  $1^{\circ} 2^{\circ}$  *under* zero. All the time the wind blew hard from the west, but the sky remained perfectly clear; nevertheless the violence of the wind counteracted the warming effects of the sun.

Just below our camp there was a light green sandstone cropping out at  $22^{\circ}$  towards the N.  $74^{\circ}$  W.; as also a black species of rock, extremely fine-grained and traversed by white veins, which cropped out at  $52^{\circ}$  to the N.  $65^{\circ}$  E., forming small ridges or swellings in the otherwise soft surface.

The route that the camel caravan had taken ran north of the mountain-mass T', and traversed pretty level ground with scanty grass. In order to reach Camp XLVIII (alt. 5,073 m.), situated in the throat of one of the small glens in the range, they had to cross over its main crest. Judging by the general orographical arrangement, I should say that the latitudinal valley which they then followed, and in which they passed two miniature lakes, debouches upon an extensive open plain, a sort of expanded latitudinal valley, in which they made their Camp XLIX. At the mouth of the glen in which they formed Camp XLVIII they found some grass and *japkak*. Immediately south-west of the same was a chain of hills, pierced by the continuation of the river beside which Camp XLVII had stood.

On 13th September we followed the glen down which runs the brook of our camp, the ground being hard and excellent for travelling on. After the past cold nights there was but little water in the brook, which flows towards the west. After a while we quitted this valley, and ascending a side-glen on the right, crossed over a very low saddle, on the left of which the surface was again a mass of boggy mire. Between the saddle and the main glen below there intervenes a detached bluff, consisting of nothing but soft materials. Down from the saddle to the main valley runs a brook, which in its lower course has cut its way deeply into the sandy ground, so that it has distinct terraces on both sides. What little current there was carried the sand along with it, so that it had the appearance of a thick stream of porridge. On the north this narrow latitudinal valley is bordered throughout by a

rather low mountain-range, dominated by several quite small peaks, only one of which appeared to be hard rock. On the left rises a much more imposing mountain-arm, and out of it numerous side-glens issue, the upper reaches of which appeared to be a long way from our line of march.

From the little saddle or pass (alt. 5,107 m.) we descended into the main glen, which makes its way west with slight windings. The running water, however, occupied then only a fraction of the breadth of the bed. The ground underfoot was moist all the way across, and whilst it did indeed bear, it yet wobbled alarmingly under the weight of the camels. When this glen at length grew too narrow, we turned from it to the right and made our way north-west across open, broken ground. The mountain-range which we had hitherto had on our left (fig. 111) continued onwards towards the west, and in the same direction the river also became lost to sight; probably it empties sooner or later into some lake. On the other hand the mountain-range which we had had on our right came here entirely to an end. To the north of it are a couple of large ranges, running from east to west, and far away to the north a snowy range, probably the range at the southern foot of which we made Camp XXVIII. The country was flat and level for an immense distance towards the N. 30° W. The surface consisted of nothing but soft red sand, with little knobs of sandstone sticking up through it here and there. A sprinkling of grass. Camp XLIX was situated beside a tiny freshwater pool, at an altitude of 4,903 m.

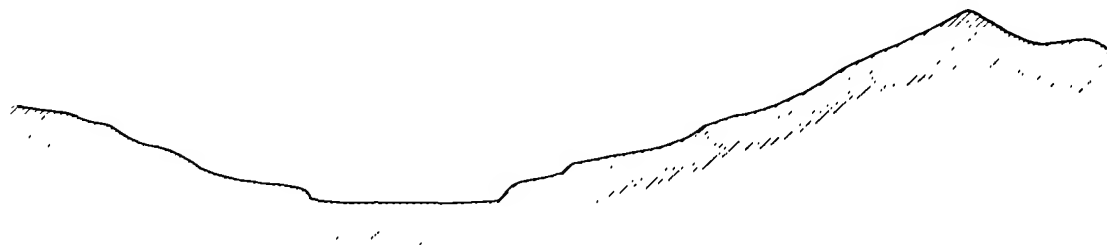


Fig. 111. VERTICAL SECTION OF THE VALLEY.

In the lower part of the main watercourse there was red sandstone dipping 60° W. and this dip appeared to predominate throughout the day, though the colour of the sandstone sometimes changed to light green. As a rule the rock only crops out in the faces of the eroded terraces, more seldom out of the soft, level ground. Apart from this there was no hard rock, unless it were higher up nearer the summits of the ranges, which it would have cost us a great effort to reach. Here and there were loose fragments of a rather fine conglomerate.

September 14th. For a short distance the ground still continued to be broken. Here were two small brooks, running west-south-west, and probably uniting with the principal river of the day before. The nearest mountains on the south were low. Due east was a large snowy range, which appeared to incline to the south-east. We advanced towards the north-west, and so approached the mountain-chains on the north. Due east we perceived the terminus of the latitudinal valley which no doubt runs north of the mountain-mass T'. After that the surface became quite level, and often it was impossible for the unaided eye to tell in which direction it

sloped. The ground, which consisted of sand, earth, or gravel, was everywhere hard and capable of bearing; here there were no marshy places, the reason doubtless being that the sand lets the water run through it. Farther on we crossed over some tiny rivulets, as well as waterless, though slightly moist watercourses, coming out of the northern mountains and running towards the west.



Fig. 112. CAMP L.

Kulans and orongo antelopes were here quite common, and once we even saw a flock of arkharis or wild sheep. On our left we passed a miniature lake or rather large pool, which quite unusually stretches from north to south, while on the west it is bordered by a sharply outlined terrace-like elevation of the surface. It is into this pool that all the brooks of the region gather. North-east of the large pool there are several smaller ones. One of these, a peculiar double pool, is entered by the arms of a large brook, which divides quite close to its mouth. The country here is almost perfectly sterile. As a rule the channels down which the brooks run are broad and filled with mud, and show a tendency to split into deltaic arms.

After that the country is again broken, forming a labyrinth of sandy and earthy hills, thinly sprinkled with grass. Amongst these lie an incredible number of small self-contained basins, each with a tiny salt pool in the middle of it, most of these having no visible affluent. Some of them were at that time without water, though the moist mud at the bottom betrayed that they had contained water re-

cently. At Camp L there was a freshwater spring, and around it short but scanty grass. The altitude was 4,890 m.

That day the weather was very peculiar: instead of the usual hard wind from the west, that is so tiring, it blew in the morning from the east and the sky became heavy with clouds. After that they discharged their contents in various different forms, partly as fine drizzling rain, the temperature rising meanwhile to  $+11^{\circ}$  at 1 p. m.; then after the temperature had dropped several degrees, it turned to mingled rain and snow; and finally, upon the thermometer going down to the freezing-point, we had snow, hail (sleet), and drifting, blinding snow. In one and the same squall in summer it was generally possible to observe that the precipitation came down in the following order — rain, hail, and snow, and often rain again. The rarest form is actually frozen hail, the pellets hard and bright. Snowy hail — small round hard intensely white grains — is perhaps the commonest form assumed by the downfall. From 5.30 to 8.30 p. m. the snow fell in the stormiest fashion. The wind, which blew at a velocity of rather more than 9 m. in the second, came from the north-east. The face of the entire country was buried under a close coverlet of snow, which did not disappear for several days. On the windward side of my round *yurt* (tent) the snow was piled up into a circular wall 3 dm. high, assuming precisely the same shape as the circular dunes which form around the tamarisk-mounds in the desert. It went on snowing, though nothing like so heavily, until midnight.



Fig. 113. THE 15TH SEPTEMBER.

September 15th. One thing which proves clearly that the mountain-ranges in this part of Tibet run north-west and south-east is that day after day we were able to march towards the north-west without crossing over any mountains, nay even without once seeing hard rock, nothing but soft desintegrated materials. The land-



THE DYING ALDAT'S BED ON A CAMEL, SEPTEMBER 23.



*Ljustr A B Lagrelius & Westphal.*

THE CAMELS DRINKING AT A FRESHWATER POOL.





scape is therefore very monotonous, and this was especially the case during this day's march; there were literally no outstanding features of any kind to arrest the eye. On the right we passed a large pool, which thrusts out two bays towards the north-east, and is entered by what was then a very small brook. On the whole the surface appeared to slope towards the north. It was only in this direction that we saw any big snowy mountains, though it was often difficult enough to distinguish them from the white clouds which hung above their summits. Pools occurred here and there at intervals, and the ground bore a thin sprinkling of grass. Everywhere, more or less thickly scattered over the surface, were loose fragments of a hard tuff-like rock, plentifully studded with air-vesicles.



Fig. 114. A CAMEL SINKING IN SOFT GROUND.

The wild animals we saw that day embraced kulans, orongo antelopes, bears, wolves, foxes, and marmots. In fact, wherever the latter occur one may be pretty certain to find bears as well. The altitude of Camp LI was 4,997 m.

September 17th. North-west of this camp the country assumed a very unexpected character, not at all conducive to the comfort of the caravan. The undulating surface was as it were paved with sharp-edged fragments of tuff of all sizes, which formed a continuous covering, without permitting so much as a square foot of the underlying surface to be seen. Very often this tuff pavement thrust sharp points up through the soft ground, and against these the camels wounded their feet till they bled. And if by any chance there did happen to occur a strip of ground free from this »pavement», the opportunity was seized upon by the earth-rat, a very common rodent in these regions, to dig out its burrow. All day the country was in this way like a roughly paved street. The ground remained frozen until well on in the forenoon, and the fragments of rock thus became fixed fast in the soft soil; but when the sun began to thaw the ground, the latter turned terribly miry. We

had travelled as it were upon ice resting upon ooze, and when the frozen surface softened the animals went through; on one occasion one of the camels only just escaped »drowning» in the liquid mud. In a word, it was the same sort of region as on the mountain south of Camp XXIV.



Fig. 115.



Fig. 116. VERTICAL SECTION OF VALLEY.

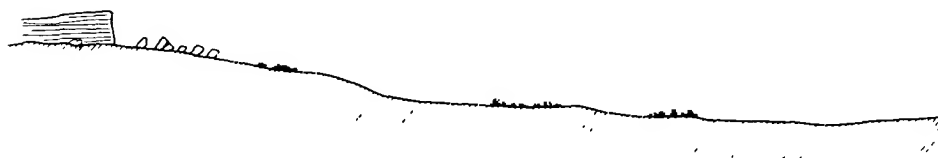


Fig. 117. VERTICAL SECTION AT CAMP LII.

After passing two small pools, we approached, northwards, a glen of peculiar formation. On the south its only boundary is a flat-topped ridge or swelling rising not more than 100 m. above the bottom of the glen. But the slopes leading down to the bottom are not only strewn with soft pieces of tuff, they are also so steep that it was only by dint of exercising the utmost care that we succeeded in getting the camels safely down them. Nor does the floor of the glen itself fall evenly, but is broken. From the range of mountains which we had all day on our left (including the peak A 2) three brooks descend, which lower down run together into one. This, keeping constantly to the well-marked glen, flows towards the east-north-east, until it enters a small lake, which we saw about 10 km. off; this is oval in shape, its longer axis stretching east and west. North-east of the lake rises the gigantic snowy mass Ó 1, which had long been within sight; from it too several brooks appeared to carry the water of the melting snow down to the same lake.

The bottom of this glen is in part strewn with gravel, in part soft, and in the latter localities offers pretty good grazing, which attracts large herds of yaks; the grass appeared to be better sheltered than usual in this depression. On the north too the valley is bordered by a ridge, with a gap in it, through which access is gained to an exactly similar valley running parallel to the first one. Both valleys, compressed between the terraces, sink to the bottom at an angle of about  $45^{\circ}$ . The last-named escarpment is covered with a layer of tuff, 15 to 20



A CAMEL SINKING IN MIRY GROUND.



*Ljustr. A. B. Lagrelius & Westphal.*

EXERTIONS TO SAVE THE CAMEL.



m. thick, spread out over it perfectly horizontally; its faces are vertical and its surface appeared to slope just a shade towards the north-east. The steep slopes below are littered with blocks and smaller fragments of tuff, which have fallen from the deposit above; and this scree continues all the way down to the base of the ridge, where the grass again becomes predominant (fig. 115).

By utilising a small side-glen, we succeeded in reaching the top of a third scarped ridge, which however is destitute of the protective layer of tuff. The northern slope of this ridge is so steep, that it was quite impossible to descend it directly; but we managed to get down by a side-glen similar to that by which we climbed up it. The bottom of the next principal valley we now descended into is likewise broken (fig. 116) and traversed by two brooks, which soon unite and enter the lake.

Apart from the capping of tuff, the only hard rock we passed occurred near the large pool, where there was a hard, finely crystalline variety, dipping  $56^{\circ}$  towards the S.  $30^{\circ}$  W. All the débris consisted however of tuff, fragments similar to the capping layer which I have mentioned. Camp LII stood at an altitude of 4,966 m. above sea-level.

This region abounded in game: wild yaks, kulans, arkharis, and orongo antelopes occurred in large herds; hares were very common and there were partridges on the slopes beneath the tuff.

On the 18th September the country was favourable for travelling, as it consisted of dry, lightly compacted earth, sometimes strewn with gravel of the usual kind, sometimes without it. It was very seldom that we came across a marshy bit. The snow had now for the most part melted away or evaporated. There was a sprinkling of grass almost the whole of the way.

Soon after starting we marched diagonally across two other valleys of precisely the same appearance as the preceding, and separated from one another by similar scarped ridges. Their strike was N.  $42^{\circ}$  E. It is very likely that all the brooks which flow down through these broad troughs gather into a large watercourse, and that this then makes its way into the lake at the north-east. But the next valley we came to, although running parallel with the preceding, presented a different appearance, being very broad and flat, and having a scarped ridge on its right side only, and this descended steeply to the bottom of the valley. Some kilometers higher up, above our route, this same valley is bounded on the right by the flat-topped mountain-mass B<sub>2</sub>, while on the opposite or left side are the peaks C<sub>2</sub> and D<sub>2</sub>. These, as also E<sub>2</sub>, belong to a smaller range which we had all day on our left, it being the continuation of the same range that we had on the same quarter the day before.

The bottom of this valley consisted of alluvial mud, and between a small lake, not exceeding one kilometer in length, and a couple of pools the surface was rather broken. By this we had reached the foot of the mountain, and then proceeded to ascend it by a broad gently sloping glen, with a marshy bottom and a pool, into which gather a number of brooks and torrents that issue from springs embedded in fairly good greenery. On the other side of the low flat saddle a similar glen leads down to the north-west. Its little brook courses down a well defined channel with grassy banks. Afterwards it turns towards the north-east, and enters

the large lake above mentioned. The glens on both sides of the little pass are wholly of secondary character, and fill the space between the range which we still had on our left hand and a smaller ridge, independent and quite short. Finally we travelled west, still keeping to the foot of the range on the left. Consequently this same range, which farther west runs from east to west, in this region forms an elbow and turns to the south-east. On the right, that is towards the north, we now had a broad, flat, open *kajir*, or latitudinal valley, which on the whole appeared to be barren, and as its surface did not look very trustworthy, we preferred the firmer, though more broken, ground at the foot of the mountains. This latitudinal valley, in which we were now to spend some days, runs from east to west, and was here bordered on the north by a not particularly high range, forming the westward continuation of the snowy mass Ö<sub>1</sub>, on the south side of which we fancied we could detect a couple of small glacier arms. This snowy mass must be identical with that which we had seen to the west of the great glaciated mass in the vicinity of Camp XXVIII. In places the northern range presents a peculiar scarped formation of a red colour.

The above-mentioned oval lake appeared to be barely 10 km. long; it lies in the latitudinal *kajir* valley, but clearly nearer to its northern than to its southern side. Camp LIII was made in the entrance to a side-glen, at an altitude of 4,879 m., and beside a prattling brook, that runs down to the lake just alluded to. This lake should lie almost due west of the great freshwater lake above Camp XXXIII. It appeared to be fed by a not inconsiderable stream, but in contrast with the lake-complex at this last camp, it is quite a solitary sheet of salt water, unconnected in any way with a twin freshwater lake. Somewhere between this salt lake and its nearest neighbour on the west in the same latitudinal valley there exists a water-parting, though from our more elevated route we were unable to determine where it was; for, although we commanded a wide view of the entire valley, its bottom appeared, so far as we could judge by the eye, to be perfectly level, and it was only the two lakes and the streams feeding them from opposite directions that suggested the presence of the water-parting.



*Ljustr. A. B. Lagrelus & Westphal*

A VIEW ACROSS THE LATITUDINAL VALLEY FROM THE MOUNTAIN-FOOT NEAR CAMP LIV.





## CHAPTER X.

### BACK TO THE ARKA-TAGH.

On 19th September we continued our journey towards the west, still keeping along the foot of the mountains on the south; consequently there was no noteworthy change in the scenery. All day we had on the north the same mountain peaks, seen however from different angles; of all these I took compass-bearings. The ground

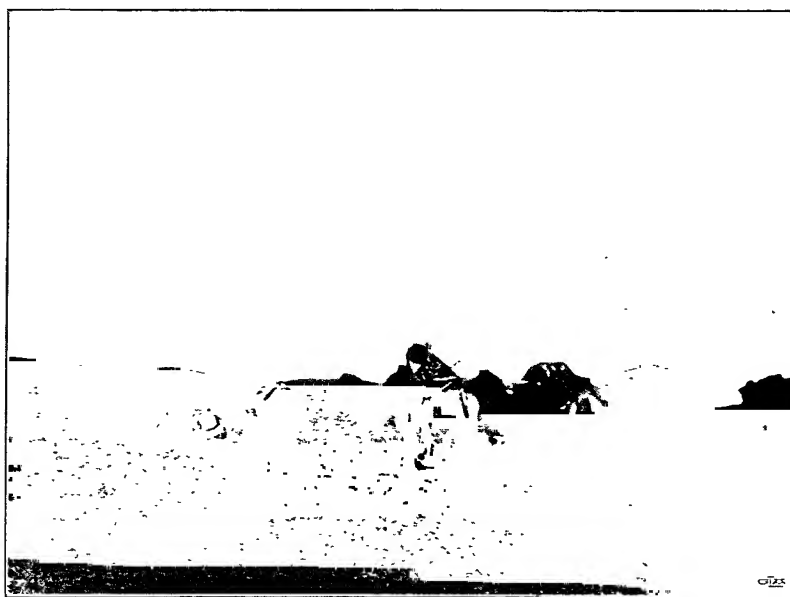


Fig. 118. COLLECTING FUEL ON THE ROAD.

was hard and level, and scored occasionally with dry watercourses, issuing out of the side-glens that open on the south. In one place we found springs of bright, fresh water, trickling out of the ground and forming shallow basins, the water in which had a temperature of  $15.6^{\circ}$ , and this probably remains fairly constant during the winter, for a species of small Crustacean\* lives in it. We only saw hard rock at Camp LIV (alt. 4917 m.), namely a light green crystalline schist and a variety

\* See vol. VI, Part I, p. 67, *Zoologie*, by Prof. W. Leche.

of close-grained brittle rock of a blue-green colour. The former dipped  $68^{\circ}$  towards the S.  $20^{\circ}$  E. The peaks L<sub>2</sub>, M<sub>2</sub>, N<sub>2</sub>, belong to an imposing mountain-mass in the southern range. In it are several other peaks with snowfields of medium size, and to the north it sends out short, rounded spurs, with brooks running down between them. The slopes are often clothed with short, thick grass, on which we counted as many as two hundred wild yaks. During the last few days the weather had been especially favourable and the rainfall slight.

September 21st. At Camp LIV the latitudinal valley was joined by a larger transverse glen that pierces the southern range, and is traversed by a pretty broad rainwater channel, though, unlike several smaller ones farther west, this contained at that time no water. Probably it only carries a flood occasionally, after rain or when the snows melt. There is however a spring in a small tributary channel on its left side. The brooks farther west are all small; only one of them carried as much as 1 cub.m. in the second.

On we went towards the west-north-west, the great latitudinal valley being enclosed between distinctly shaped, though irregular, mountain-ranges, which are in places broken through. In the middle of the valley there was now a main stream, which after picking up the torrents from both sides flows down to the lake we had just left behind us in the east.

Most of the brooks here flow in narrow, more deeply excavated beds, but later on we passed a broad, shallow watercourse, with a gravelly bottom and without water. This too appeared to carry down rain-water at rare intervals, and not to be fed in any way by spring-water. Shortly after this we passed a *bel*, or low saddle, situated in a flat offshoot of the southern range. But although low, this saddle possesses great morphological importance, for while on the east of it the water flows towards the north-east, to the west of it it flows towards the north-west. Hence the northward prolongation of the saddle would coincide with the water-parting of the latitudinal valley; but it was so low, that from our higher position we were unable to distinguish it. It was only by the relief up on the mountain-flanks that we were able to discern, that we were passing out of one self-contained basin into another. From the saddle an entirely new scene, with new mountain-peaks, unfolded itself towards the west, while the country we had recently travelled through disappeared behind us. We now skirted at pretty close quarters the peaks M<sub>2</sub> and N<sub>2</sub>; their north-western slopes were buried under rather heavier falls of snow. Between two dome-shaped bluffs we saw a rudimentary glacier-arm proceeding from a small *firn* region. The snow-line appeared to lie 120 to 150 m. above the saddle or *bel*; though on the southern side of the mountains it ranges a good deal higher. The range to which this snowy mass belongs is continued still farther towards the west, but then decreases in altitude and becomes free from snow.

The new lake lay to the north-west, stretching as usual from east to west, and having along its south-eastern shore a flat strip of low-lying overflow country. The eastern part of the lake appeared to be very shallow and to be dotted with several small flat mud-islands. Along its northern shore are low, rounded hills, of a red appearance and apparently barren. All the torrents from the southern mountains run directly into the lake; they are bordered by soft rounded hills, prominently convex.

Pl. 27.



*Ljustr. A. B. Lagrelus & Westphal.*

MOUNTAINS SOUTH OF CAMP IV.



In the mountains above the glen in which we pitched Camp LV, at an altitude of 4838 m., there were arkharis. Down in the latitudinal valley, with its dry ground and absence of marshy tracts, marmots were abundant.

The only place at which we saw hard rock in this valley was at the sharper angles at this camp, namely a hard, brittle variety, greatly weathered, of a light colour, and dipping  $79^{\circ}$  towards the N.  $15^{\circ}$  W. Everywhere else the rocks are covered with earth, as indeed we might naturally expect in an open, shallow latitudinal valley, which has served as a gathering-basin for the products of disintegration from every side.



Fig. 119. HILLS ON THE SOUTHERN SHORE OF THE LAKE

September 23rd. Still travelling west, we approached the southern shore of the lake at an acute angle, crossing as we did so over the greatly diversified lower slopes of the hills. These were composed of reddish yellow sand and earth, with a thin sprinkling of grass. Some of the deeply excavated watercourses were dry, others carried a little water, but in every case alike their bottoms were generally soft and marshy. All the glens open out in trumpet fashion upon the flat strip of shore. One of these was about 300 m. broad in its lowest part, and its bottom for almost its entire breadth was covered with a thin sheet of water, intermingled with red sand. It flowed in a peculiar rhythmical and pulsating manner, as though the springs which supplied it were gushing out intermittently. The cause of this was evidently

the stream picking up the burden of sand here, and depositing it there, and the fact that these processes were repeated by jerks, or fits and starts, time after time.

The southern shore-line is not indented by any noteworthy bays, or diversified by islands, with the exception of one large crescentic mud island, just below



Fig. 120. SCENES FROM THE BURIAL OF ONE OF MY MEN AT CAMP LVI.

Camp LV. There is only one cape of any size, and it consists of mud, formed by the deltaic arms of a brook. East and west of it are a couple of intensely salt lagoons lying quite close to the shore; the shore itself consists of gravel and sand, and is perfectly hard and solid. The water is, as I have just said, intensely salt, yet

bright. Its temperature was  $16.6^{\circ}$ ; but then the temperature of the air was unusually high, namely  $17.5^{\circ}$ . Probably the cause of this local mildness may have been the amount of solar heat stored up in the water during the summer, and the temperature maintaining itself a good deal higher than usual.

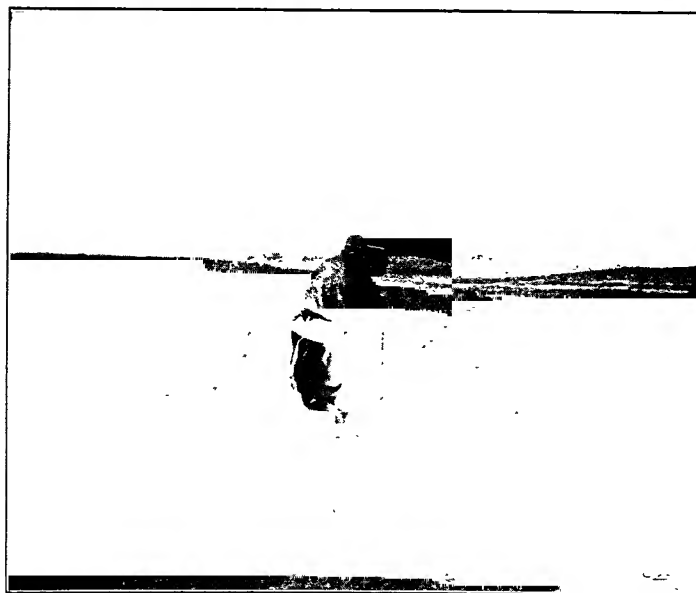


Fig. 121. SCENES FROM THE BURIAL OF ONE OF MY MEN AT CAMP LVI.

This lake is about 15 km. long, its western end being rounded, and shallow, as well as plentifully studded with mud islands and so diversified with capes that it is impossible to make out the actual shore-line. It lies at an altitude of 4800 m. Immediately west of it the ground is flat and whitened over with incrustations of salt; here too there were pools. All this water appeared to have been left after the lake



dropped from a higher level, and it was even then undoubtedly subsiding, the inflow having appreciably fallen off. At its south-western corner it is entered by two dry torrents, but it is not joined from the west by any stream worth speaking of. The next self-contained basin, one of very small area however, approaches quite close to it. This made the fourth lake we came across in this great latitudinal valley. Had we been traveling east, we should have had no great distance to go before we came to some of the head-streams of the Jang-tse-kiang, no great distance that is from the eastern end of the great salt lake. Had we proceeded along the same valley west from the lake at which we have now arrived, we should beyond doubt have found a chain of other lakes, arranged in precisely the same manner as the 23 lakes which I discovered in 1896 in the big latitudinal valley immediately south of the Arka-tagh, and in exactly the same manner as the lakes which Wellby and Malcolm discovered that same year in the next latitudinal valley to the south.

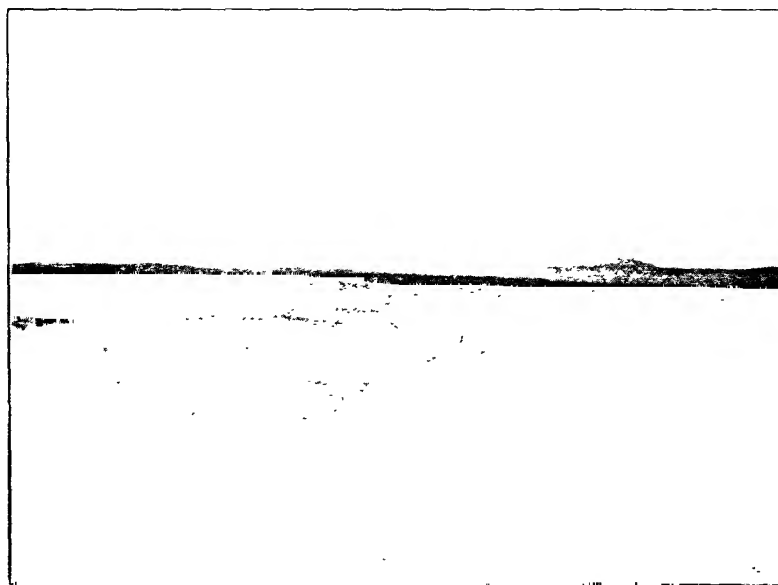


Fig. 122. SCENES FROM THE BURIAL OF ONE OF MY MEN AT CAMP LVI.

Leaving behind us the strip of barren alluvial ground at the western end of the lake, we travelled north-west over a gently rising surface. The ground was dry, and consisted of red sand and earth, with a thin sprinkling of grass. The water-courses were all treacherous, and here and there we came across a pool.

At Camp LVI (alt. 4828 m.) I took the temperature of the ground at different depths, and, with the temperature of the air at  $9^{\circ}$ , found that at a depth of 25 cm. the ground temperature was  $8.4^{\circ}$ , at 40 cm.  $6.1^{\circ}$ , at 55 cm.  $4.9^{\circ}$ , and at 70 cm.  $4.3^{\circ}$ .

September 24th. We now crossed the latitudinal valley diagonally, making for a gap in the northern range. On the whole it was in that direction that the surface rose, the ground consisting everywhere of red sand, perfectly firm and hard, though scored by a number of deeply excavated ravines, each with a level bottom. Down each of these there generally trickled a tiny rivulet, making its way

eastwards into one of the miniature lakes that lay between our line of march and the large lake. All these watercourses were veritable streams of liquid ooze or mud ditches, treacherous to a degree. In some of them we might easily have been swallowed up in the mire, had we neglected the precaution of testing them first before venturing to cross them. It was only very few of them that were dry enough to bear sufficiently. These streams have cut their beds 30 to 50 m. deep into the soft material, and the sides of the red hills through which they wind descend steeply into them. The country is as it were honeycombed or chequered by the effects of this unusual erosive energy. In the expansions of these beds it is no uncommon thing to see detached, truncated mounds of the same soft material, shaped and modelled by the action of the water. This conformation extends all the way to the foot of the northern range. All these streams appear however gradually to run together and to empty into three small lakes which we saw a pretty long way off in the east. The latitudinal valley still stretched away westwards between its bordering ranges, the crests of which were however rather unequal as regards altitude.

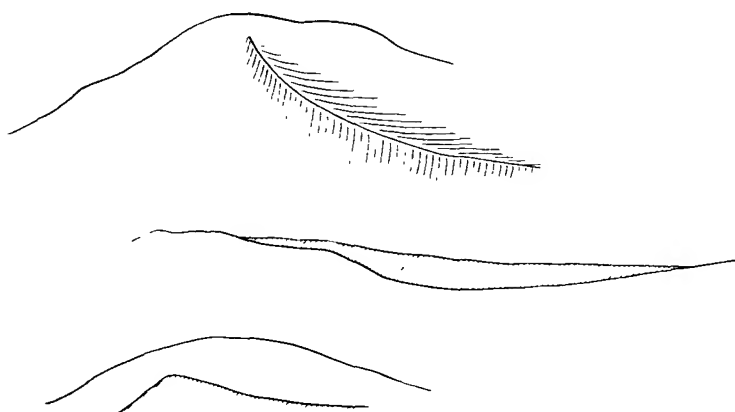


Fig. 123. THE DUNE NEAR CAMP LVII.

At length we entered the glen that leads up to the saddle-like gap in the crest of the northern range. On the whole the glen runs pretty straight from north-north-west to south-south-east, though not without describing a number of small windings. Its bottom is choked with chips of sandstone of a faint red colour, as well as with larger pieces of every conceivable size. A little brook runs down to the most northerly of the three lakes I have mentioned. The sides of the glen are very steep, and are dotted over with small patches of thin grass. The ascent gradually grew steeper, until at last we became very sensible of it. Higher up the fragments of sandstone were scattered over a miry marsh. The first section of the pass that we came to consisted of the same soft material. The second, which lies quite close to the first, has the same altitude, namely 5095 m. Between these two secondary passes, we thus have, on the very summit of the range, a flat self-contained basin, with a small pool in the middle of it, fed by two or three brooks. North of this little basin there is yet another, rather larger, and at a somewhat lower level. The central pool in the latter basin is also rather larger, and was even at that time entered by a couple of rivulets.

Red sandstone was everywhere predominant, though it was extremely seldom that it showed as hard rock. At the beginning of the day's march the dip was  $10^{\circ}$  towards the S.  $50^{\circ}$  W., and a dark, rather fine-grained conglomerate, which cropped out there, dipped  $10^{\circ}$  towards the N.  $65^{\circ}$  W.; but neither of these determinations is quite reliable, because it was impossible to be quite sure that it was the outcrop of the hard rock that we had to deal with. Nor did the glen leading up to the pass offer anything more definite in this respect, though often we would see the sandstone fragments arranged in long rows like books on a bookshelf.

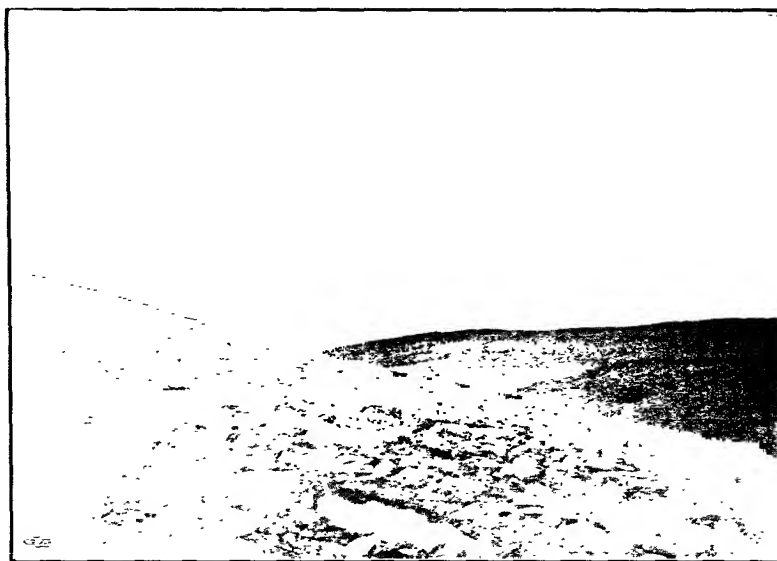


Fig. 124. A HILL SLOPE NEAR CAMP LVII.

September 25th. The self-contained basin in which Camp LVII was pitched has, quite close on the north, a low, flat crest (alt. 5138 m.), and on this, immediately west of our route, rises a relatively low, flat, dome-shaped mountain, on the eastern flank of which was a solitary, distinctly outlined dune (fig. 123). Its crest, drawn with the utmost sharpness, pointed towards the east-south-east, and its northern slope was flat, while the southern was steeper. The dune has formed on the side of the mountain that is sheltered against the west wind; but it is very strange indeed to find so large a dune just beside this mountain, when there are none beside any other in the vicinity.

North of this crest come two other small basins, each containing its pool; the more northerly one is bordered by a low crest (alt. 5151 m.), from which we descended pretty steeply into a rather large glen, the brook in which flows east-north-east in a winding course between red terraced slopes. On the left we passed some dominating peaks, one of them in part covered with snow. From the left-hand side of the brook we then climbed slowly up over hard, firm ground, until we were compelled, by a small detached ridge farther north, to turn off to the north-east, whereupon we crossed over a large glen running towards the east. We crossed a third similar glen on the north side of a flat saddle.

Then we crossed over yet two other cols, with a minor glen between them. In a word our route led at right angles across a number of small crests, and rami-

fications of the mountains, but the differences of altitude between the bottoms of the glens and the cols were very slight and the slopes were flat. To the east we perceived several dominating peaks, one or two of them with snow. All these belong to the main range that borders the next latitudinal valley we should come to. After passing a pool, we crossed over yet two other small cols, the higher of which reached an altitude of 5112 m., this being the last in the series, and after that we definitively descended the northern slopes of this broad flat main range. From the top of the last pass we commanded a splendid view of the next latitudinal valley; it appeared to be bounded by low hills on the north. This new valley was hard and excellent to ride upon. It lacked however a main stream, having nothing but small, dry watercourses running now in one direction, now in another, so that it was almost impossible to tell which was the lowest part of the valley. Judging from the last watercourses that issue from the red mountain range, the fall is towards the east. In both that direction and in the west the country was quite open to the far off horizon. In the middle of the latitudinal valley were some solitary blocks of schist; and some of the small pools it contained had white rings round them, pointing to the presence of salt. The surface was perfectly sterile until we reached the first foot-hills on the north side of the valley. There we hit upon a freshwater pool, with a thin sprinkling of grass round it; the pool must plainly be fed by springs and must possess a subterranean outlet, for there is no visible emissary flowing out of it. The altitude of Camp LVIII was 4991 m. and of the bottom of the valley 4988 m.

Thus the character of the country had in the course of the day essentially altered. Not only were the mountains lower than heretofore, but the surface was again barren. For 30 km. we did not find a blade of grass, and only once a little moss amongst the gravel. The consequence was an entire absence of game. Even ravens, which never fail in other parts, were here wanting.

Immediately north of Camp LVII the red sandstone dipped clearly  $10^{\circ}$  towards the N.  $70^{\circ}$  W. At the base of the terraced bank of the first large stream flowing towards the east the same rock cropped out at  $54^{\circ}$  towards the S.  $60^{\circ}$  E., but here it was excessively brittle and weathered. At the same place we found gypsum, and again a little farther on, in thin bright laminae, embedded in the sand and soft disintegrated debris of the red sandstone. The entire country hereabouts was of a brick-red colour — the ground, the hills, the mountain crests, all alike were red, except for an occasional small patch or strip of white, indicative of salt or gypsum, but not of snow.

A little farther north we came across a very hard, fine-grained, dark crystalline schist, containing veins and dykes of lighter and coarser crystallised rocks; its dip appeared to be  $83^{\circ}$  N. North of that again was a dark argillaceous schist, very much weathered and very friable, and split into thin laminae with a dip of  $48^{\circ}$  S. In the upper part of a series of small, low detached heights, which projected above the ground in a glen, there cropped out a yellow variety of rock, brittle and very friable; and finally the schist appeared once more, dipping  $71^{\circ}$  towards the S.  $80^{\circ}$  W.

Thus the southern parts of the main range that we had just crossed over consist of red sandstone, while its northern parts are composed predominantly of

black schists; though by far the greater part of the range constitutes merely a ruin of these two rocks, an inextricable chaos of heaps of *débris*, of slabs of sandstone and schist. It is very rarely however that the hard rock crops out in a recognisable form, and then only in the crests and at the bases of the terraces of the more deeply excavated watercourses. It is nevertheless difficult to point out the provenance of the blocks of schist which lie in the middle of the latitudinal valley, seeing that its floor is perfectly level and composed of nothing but very finely comminuted material. They are either erratic blocks, surviving from some long vanished glaciers, or the remains of a ridge which has otherwise totally disappeared underneath the gathering disintegrated material with which the valley is filling up.



Fig. 125. A CAPTIVE «DAVAGHAN».

September 26th. We marched north-north-east between two chains of hills, having on the left three pools of fresh water, partly frozen over, and on the right a larger pool of the like character. After surmounting a col, only a few meters higher than Camp LVIII, we descended into a self-contained basin, going down beside a minor watercourse that led to a small lake. Several similar watercourses, some with water, others without, but all with marshy bottoms, come down from the north-west and enter the same lake. When we reached the farther side of a pool, on the southern slope of a minor crest extending from east to west, the grazing showed some improvement over what it had hitherto been. The altitude of Camp LIX was 4964 m.

September 27th. The usual pretty stiff westerly wind now prevailed again, and blew all day with a velocity of at least 10 m. in the second. The rainfall was however so slight that the ground was generally quite dry, and the sand and dust blew off the hills in clouds. It was only in the hollows and depressions that the surface still remained moist and marshy. From the little pass just north of our



*Illustr. A. B. Lagrelius & Westphal.*

CAMP I.X., AT 5183 M.



camp we descended steeply to a brook that flows in a deep bed and gathers up the rivulets that issue from the mountains immediately to the west. It flows north-east to a small pool, which is probably connected with a moderate-sized lake lying farther north and stretching some 8 to 10 km. east and west; and east of this again there is yet a third pool. A bay of the first lake pointing west is entered by a second deeply channelled stream. Between these lakes, pools, and brooks a whole series of very rounded, yet steep, hills extends from west-south-west to east-north-east. On the northern side of a second similar ridge lies an elongated pool, continued eastwards by a marshy tract, through which a brook flows. Its water was transparent and perfectly fresh, as indeed it is in all the apparently self-contained pools in this region. Here grew the last grass, for after that we saw not a single blade for a long distance to come. Nor did we discern here any traces of wild animals, except the usual little lizard.



Fig. 126. THE ISOLATED CONICAL MOUNT SEEN FROM CAMP LX TOWARDS THE N  $72^{\circ}$  W.

After that we ascended again, crossing an endless series of the most disagreeable cross between mountain and hill that I remember ever to have seen; the sides sloped at an angle of  $25^{\circ}$  to  $30^{\circ}$ , and in the course of a very few minutes the differences of elevation amounted to as much as 100 m. It was impossible to determine where all these small rivulets, some of which were dry, while others carried water, eventually terminate, for in the very broken surface they soon became lost to sight. Possibly however they collect into some larger glen, that runs down to



the latitudinal valley which we crossed over last. Not all of these chains of hills are like miniature ranges; they resemble rather offshoots and ramifications of the higher mountainous parts that rose west of our line of march.

At length we reached the top of the pass (alt. 5203 m.), a very flat col, in the new main range, which was just as irregular, rugged, and broken as the last. There was nothing to indicate the position of the actual pass except a watercourse running north-westwards to the next large latitudinal valley. Due north of the water-divide rises a short, but craggy, ridge of a blood-red colour, and with a couple of streaks of snow braiding its loftiest eminences. From the divide small glens branch off to both the north-east and the north-west so as to avoid that lofty spur, which cuts off entirely the view of the next latitudinal valley. In these elevated regions there was not one trace of either vegetable or animal life. Our next camp was made at an altitude of 5111 m. above the sea.

Immediately north of the first minor col of the day we came upon red porphyry, forming a small protuberance. At the western bay of the lake there was an extremely hard greenstone, dipping  $41^{\circ}$  towards the S.  $42^{\circ}$  E., and shortly after that a very hard sandstone dipping  $67^{\circ}$  towards the S.  $31^{\circ}$  W. North of the lake, on the west side of a pool, a hard crystalline schist appeared with a dip of  $36^{\circ}$  N. On the top of a hill near the elongated pool we found a rather fine-grained conglomerate. Farther north the crystalline schist again made its appearance, dipping  $87^{\circ}$  towards the N.  $5^{\circ}$  E. and  $47^{\circ}$  S. Finally, in the vicinity of Camp LX we had quartzite, but like all the preceding varieties cropping up in small protuberances only out of the all pervading soft disintegrated material.

September 28th. The brook beside which we had encamped turns towards the north-west and bursts through the craggy spur in a rather narrow defile, choked with gravel and blocks of stone. On both sides the defile is hemmed in by dome-shaped granite summits, and in between them plunges the stream as if entering a narrow portal. The little crest continues a short distance towards the west. The volume of the brook was at that time somewhat swollen, after a fall of snow which took place during the night, followed by a very warm sun in the morning. It was frozen to the bottom underneath, and the gravel below was covered with cakes of ice, which had clearly formed during the night.

After emerging from this narrow defile, the brook turns to the north and north-east, no doubt making for the nearer of two lakes which we saw farther east in this same latitudinal valley. We continued towards the north-west, travelling along the flat slopes and having on our left still other dome-shaped elevations, belonging to the distinctly marked range that rises immediately north of the water-divide in the main range. The watercourses that we crossed all ran towards the north-east, and consequently did not appear to belong to the medium-sized lake which we were approaching from the south, but probably belonged to the lake-basin lying next to it on the east. At that time only one of these watercourses contained water. All the brooks beyond the left bank of this particular one ran down north-west to join the lake. Although they were all dry, one of them contained a little natural spring. On the southern shore of the lake we again found grass, but it was of wretched quality. Here we pitched Camp LXI, which we were to visit again on a later excursion; its altitude was 4948 m.

Immediately after leaving Camp LX all the débris was composed of red and grey granite, conjoined with dark crystalline schist. The distinctly marked crest with the dome-shaped summits consists of bedded red granite, with a dip of  $83^{\circ}$  towards the N.  $30^{\circ}$  E. Its disintegrated matter, which not only fills the small eroded water-courses in the mountain's flanks, but also forms a scree of débris at its base, is of a very fresh and vivid blood-red colour. In the narrow transverse defile I observed a variety of grey granite in the face of the cliff. South-west of the exit from this defile are various minor hills buried under débris and slabs of brick-red sandstone. In the last of the glens running north-east the crystalline schist again cropped out with a dip of  $30^{\circ}$  towards the N.  $30^{\circ}$  W.; it was severely weathered and formed very small ridges projecting just above the ground. Farther on, near Camp LXI, the same rock had a lie of  $43^{\circ}$  to the S.  $30^{\circ}$  W. and of  $72^{\circ}$  to the S.  $30^{\circ}$  W. In the latter localities it alternated with strata of a coal-black argillaceous schist.

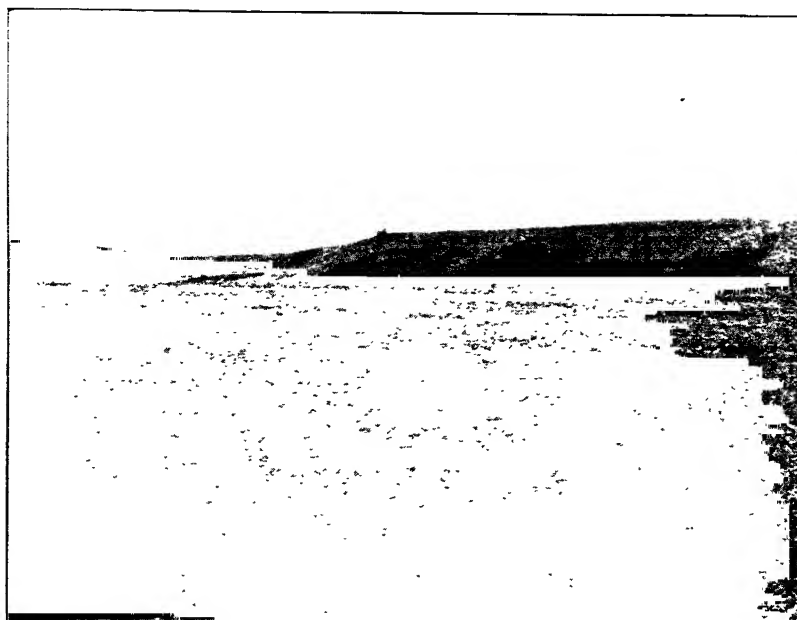


Fig. 127. THE DEFILE AT CAMP LXI.

During the greater part of the day a storm raged from the west, the wind blowing at a velocity that quickened up to 23 m. in the second, while every now and again we had a hail-squall. The storm swept the dust and drift-sand, and even small stones, before it along the slopes of the mountains, careering down the broad open valley like water in a river-bed. The clouds, which almost brushed the surface of the earth, raced eastwards at terrific speed. In the partial shelter of a flat hill on the southern shore of the lake the velocity of the wind was however only a little over 14 m. in the second. But at 8 o'clock in the evening the storm stopped just as suddenly as it began, and was followed by an hour's perfect calm. At 9 the wind began to blow again, fitfully and in squalls, from every quarter.

September 30th. The eastern shore of the lake is slightly broken; there are small soft hills bearing scanty grass with an occasional pool. East of our line of

march the lake basin was bounded by small ramifications and offshoots of the main range that rises above the latitudinal valley on the south, and beyond these lies the smaller lake. The former, larger lake sends out to the east a bay, or rather perhaps a lagoon, which connects by means of a narrow sound with the smaller lake on the east. This receives also a second stream from the east, which, after breaking through the hills, enters the lake by two arms, and each of these at the time of our visit carried a volume of 1 cub.m. The water in the lagoon was therefore fresh, whereas the sp. gr. of the water in the lake was 1.0225. The sides of the brook were edged with ice, and the lagoon, which may indeed be regarded as a broad expansion of the brook, was entirely frozen over, this being no doubt its definitive winter ice. On the other hand there was not a trace of ice along the shores of the lake, partly because of the salinity of its water, partly because of the vigorous and incessant waves that beat upon them. But the lagoon was protected by the peninsula, and was frozen all the way into the outer sound beyond.



Fig. 128. ON THE NORTHERN SHORE OF THE LAKE.

Our route then lay between the northern shore of the lake and a chain of small hills which sink gently down towards the lake, and are scored by a number of small rivulets. The ground consisted of sand or fine gravel, and was barren. To the west we saw a gigantic snowy mass belonging to the Arka-tagh. Leaving the lake behind us, we made our way up a gently rising and pretty broad glen, leading due north to a part of the Arka-tagh in which there appeared to be a relatively low pass. The bottom of the glen is strewn with gravel, and seemed as though it sometimes might carry water, though at that time it contained nothing more than a trickling rill. Gradually the glen contracts, being however joined from both sides by several more or less steep side-glens. The only part of the ascent that is at all steep is the last portion, just underneath the pass itself, which reached the

same altitude as the pass in the last preceding range, namely 5203 m., but this steep portion is so short that it presented no real difficulty. The descent down the northern face is very much steeper; in fact it plunges straight down into a deep glen or gorge. In some places the outcrops of the rocks quite made steps. The small torrents from this and the neighbouring pass gather into a larger glen, relatively wide and open, though absolutely barren, and with a frozen stream down the middle of it. This pass put me forcibly in mind of the pass in the Arka-tagh which I crossed over in this same neighbourhood in 1896. In its case too the southern acclivity was easy and gentle, but the northern steep and difficult. The orographical structure of these more western parts of the Arka-tagh is very much simpler than it is in the parts where we crossed over it south of Kum-köl, for in the latter quarter the range is split up into several parallel crests.

The predominating rock all day was a green schist, the dip of which varied from  $14^{\circ}$  towards the N.  $5^{\circ}$  E.,  $86^{\circ}$  towards the N.  $40^{\circ}$  E., and  $35^{\circ}$  towards the S.  $15^{\circ}$  W. to  $29^{\circ}$  towards the S.  $20^{\circ}$  W. on the pass itself, while north of the pass it was  $25^{\circ}$  S. The predominant lie of the rocks in this part of the Arka-tagh may be taken as  $35^{\circ}$  to the S.  $15^{\circ}$  W.

On the south side of the range the wind blew from the south-west; but on its summit it changed to north-north-east, and brought with it thick, blinding snow. Here again the Arka-tagh appeared to serve as a climatic dividing-line, though, I admit, not a very rigid line. North of it the cold is generally severer, while the precipitation, especially on the northern slope of the mountains, is heavier than on the south, where the great Tibetan plateau extends far and wide, and the winds too are different.

October 1st. Just below Camp LXII (alt. 4977 m.) our glen united with a second similar glen coming from the east, and like it having its origin in the main chain of the Arka-tagh. The united glen then inclines towards the north-west, and, increasing in breadth, terminates in a wide expansion, an open arena or cauldron-shaped valley, upon which several glens debouch from different directions. On the south it is embraced between short spurs thrust straight out from the Arka-tagh. Farther to the west there are lofty snowy mountains. On the east the open arena just spoken of is bordered by a great spur from the main range, and on the north by a more independent range. In the eastern part of the glen the grazing and japkak were pretty good. The brook was frozen so hard that it even bore the weight of the camels. Camp LXIII had an altitude of 4899 m.

At Camp LXII the green schist dipped  $28^{\circ}$  towards the N.  $40^{\circ}$  W. and farther down  $57^{\circ}$  S. At the point where the glen debouches upon the open expansion the red sandstone crops out on its left-hand side at  $65^{\circ}$  towards the S.  $35^{\circ}$  W. Far away in the west, the mountains, as seen from this same point, presented the same red shades, and are no doubt composed of the same rocks.

## CHAPTER XI.

### FROM THE ARKA-TAGH TO THE GOLD-MINES OF TOGHRI-SAJ.

October 2nd. The brook, on the right bank of which we encamped, is soon joined by another, equally as large as itself, coming from the S.  $70^{\circ}$  W., and then the conjoint stream describes a wide curve from the west to the north. This afforded us a convenient and excellent road by which to get out of the cauldron-like expansion. The mountains that encircle it were then sheeted with snow from top to bottom. The floor of the glen is gravelly and hard, and slopes gradually and regularly towards the north, so gradually in fact that the brook, which was then carrying a volume of  $1\frac{1}{2}$  cub.m. — for it was also covered with patches of ice — nowhere forms cascades, indeed there was not so much as a ripple to be heard. At first it is inclosed between red hills of sand and soft soil, with sprinklings of grass and japkak. The bottom of the glen is so far unsymmetrical in that the stream flows strongest towards its left-hand side. On that side therefore the craggy walls rise bare and steep, and the side-glens that debouch upon it are very small and almost all of them without water. The right side of the glen is much less steep, and consists almost everywhere — at all events this is true of its lower part — of soft rounded grass-grown slopes, interrupted at one place only by bare, precipitous cliffs, below which the scree of gravel and rocky fragments reaches right down to the edge of the stream. The side-glens that come down on the right of the main glen are pretty large, and in several of them there are small rivulets, then frozen over. We marched almost the entire day through this deeply trenched glen, our view being effectually curtailed by the crags on both sides. Consequently I am uncertain as to the broader features of the orographical architecture; although we appeared indeed to be descending a longitudinal glen between two meridional ranges, parallel spurs of the Arka-tagh. But a little reflection serves to cast grave doubts upon the correctness of this interpretation, and at the same time suggests quite a different orographical plan. In its upper part this glen is joined by a side-glen, with a brook, that comes from the right or east, and appears to originate on a col or pass above a latitudinal valley. In that case the latitudinal valley in question must be very much narrower than all the preceding valleys, although, like them, it

does run from east to west. From *its* pass there will be a similar brook flowing towards the east, and entering a second main glen running towards the north. The latitudinal valley in question will therefore separate the Arka-tagh proper from a subsidiary range which lies parallel to it and is pierced by the river beside which we this day travelled. And this inference is further supported by the view which presented itself westwards from Camp LXIII; for the cauldron-shaped expansion was seen to be bordered on the north and north-west by a detached ridge, at any rate it is locally detached. The arrangement is therefore precisely the same as that which we find farther east near the Pitelik-darja, which is fed by the stream of this latitudinal valley, and itself breaks through one or two of the northern subsidiary ranges of the Arka-tagh. The transverse glen between Camp LXIII and Camp LXIV will thus cut through the continuation of one of these subsidiary chains, which we had crossed over when travelling south a few weeks before. The orographical disposition is however less distinct where I crossed the Arka-tagh farther to the west in 1896, although even there the main features are recognisable.



Fig. 129. VERTICAL SECTION OF GLEN.

Owing to its contributories the stream swelled a little. Eventually the glen widens out a good deal and the country becomes open in every direction; even the stream, between its strongly emphasised terraced banks, grows continuously broader. The water-marks at the sides prove that this stream can at times swell out to even imposing dimensions. We made Camp LXIV (alt. 4598 m.) in an expansion, or rather in a longitudinal glen wedged in between the chain through which we had just made our way and the next following chain, which is low.

The sandstone came to an end shortly after we left Camp LXIII, and no longer appeared as hard rock. Its place was taken by a close-grained, brittle rock, dipping  $43^{\circ}$  towards the N.  $40^{\circ}$  E.; and it was succeeded by a green schist dipping  $65^{\circ}$  towards the S.  $30^{\circ}$  W.

October 3rd. In the far off distance to the north we perceived a latitudinal range. Now that we were out in a more open country, the Arka-tagh presented rather an insignificant appearance; but then we were still too high for its relative altitude to be in any way remarkable. When seen from the Kum-köl however, it stands out as a gigantic snow-clad range.

In the expansion in which we formed Camp LXIV the stream died away in its gravelly bed; at the same time the surface, hard and admirable for travelling over, and inclining gently towards the north, is seamed by an endless number of watercourses, almost all of them then dry. A side-glen that comes down from the west or south-west contains a well-marked dry torrent, and from the south-east

arrives a similar glen, with water then flowing down it. All these small rainwater channels gather into the broad glen in which we were marching. The mountains by which that glen is shut in are of no great magnitude and their orographical disposition is not clear; originally and properly they appear to belong to a range that runs parallel to the Arka-tagh. Another large side-glen arrives from the west. Then we doubled a projecting wing of the mountains on the right and shortly afterwards a similar projecting wing on the left. There was not a drop of water

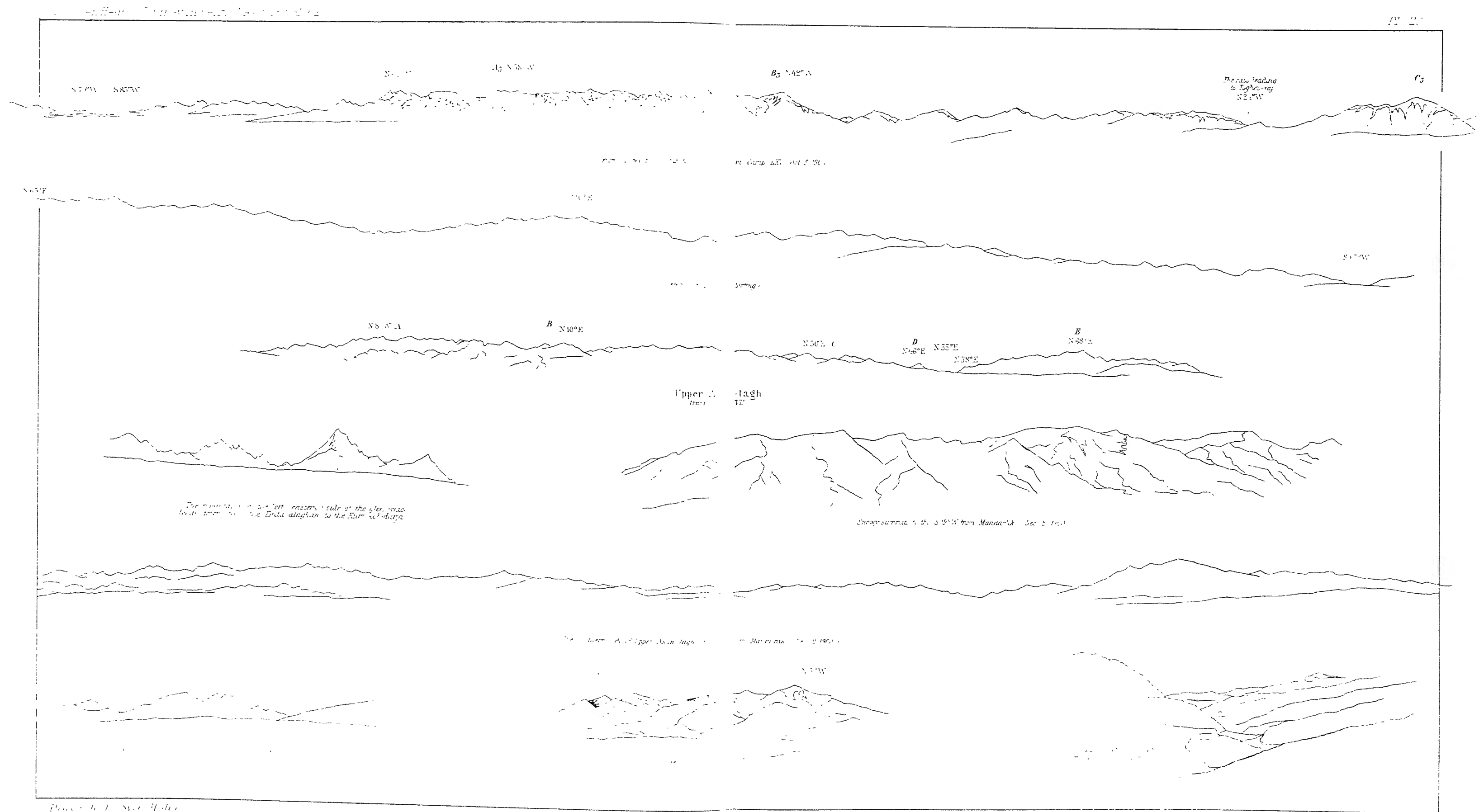


Fig. 130. LOOKING N FROM CAMP LXV.

in any of the watercourses in this valley, and all the country after that was arid. The grazing was good in places. Gradually the mountains grew less in magnitude, and finally came to an end altogether, and we crossed over an extensive plain. Yet another subsidiary range of the Arka-tagh, parallel to the two I have just described, is represented by certain small detached bluffs ranging in a line from east to west. Some 8 or 10 kilometers to the east lay the broad expanse of the Atschik-köl. Camp LXV (alt. 4251 m.) was made on the north side of a last little rounded hill, and on the right bank of a stream which flows east and enters the north-west part of the Atschik-köl. The stream itself was then beset with sheets of ice. Owing to the intense cold and the blowy weather I was deterred from visiting the lake; but it has been mapped by Roborovskij.









Although the basin of the Atschik-köl counts as one of the largest in Tibet, it cannot in point of size be compared with that of the Kum-köl. The former, like the latter, receives the greater part of its water-supply from the south, i. e. from the Arka-tagh, and like the Kum-köl it is situated in the northern part of its own basin, the amount of water it receives from the mountains that border it on the north being excessively small. These mountains, which stretch from east to west, are of great magnitude. North-west of our camp they consisted of a serrated snowy crest, which decreases in height towards the east, at the same time growing flatter and more rounded, until finally it comes completely to an end, or is merely continued in a low saddle, which separates the basin of the Atschik-köl from that of the Kum-köl. Towards the east-north-east the country is very open, though in this quarter again the basin is bordered by a low ridge or swelling.

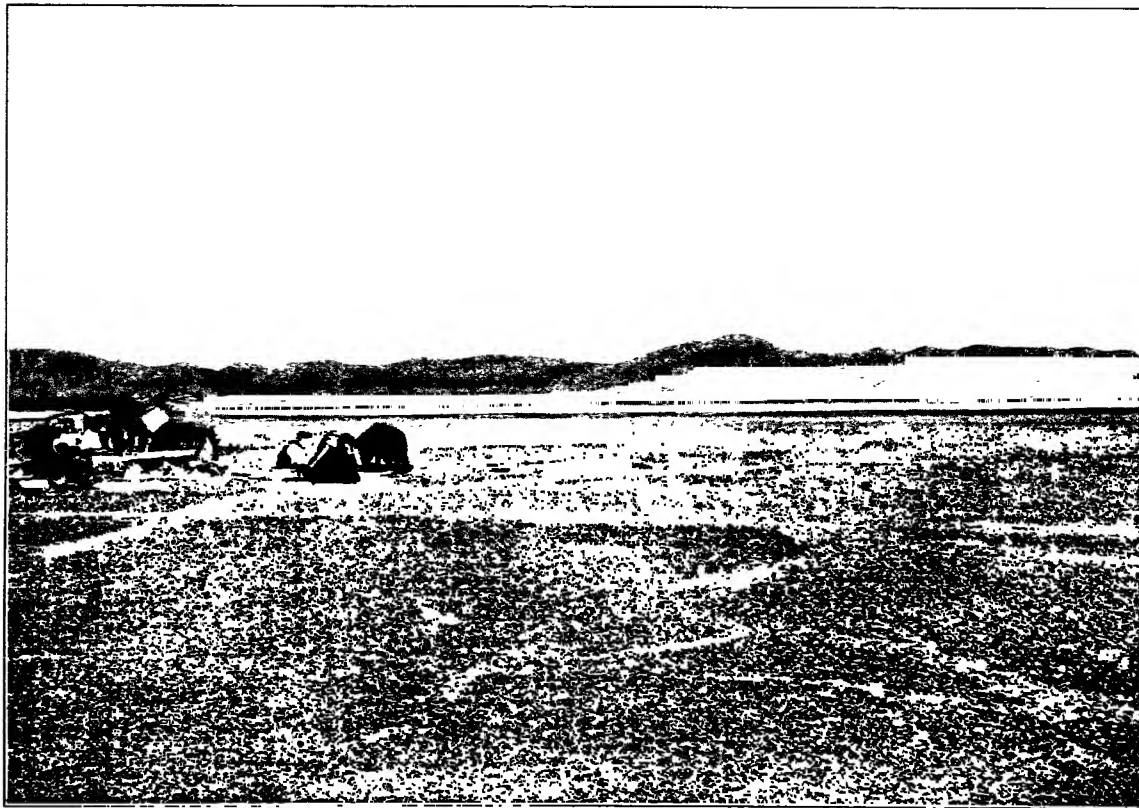


Fig. 131. LOOKING N FROM CAMP LXV (CONTINUATION TO THE RIGHT OF FIG. 130).

In the projecting elbows of the glen various kinds of green schist cropped out at various angles, e. g.,  $16^{\circ}$  to the N.  $10^{\circ}$  E.,  $55^{\circ}$  to the N.  $40^{\circ}$  W.,  $65^{\circ}$  to the S.  $15^{\circ}$  W.; while close to Camp LXV the larger, close-grained rock cropped out at  $47^{\circ}$  to the S.  $25^{\circ}$  W. Thus the outcrop looks towards the lake, and below the cliff is a scree of detritus and sand.

The sky was now for the most part clear. On the 3rd October the wind blew hard from the west, with a velocity of 15 m. in the second. From the thick

clouds of dust and sand that were whirled up it was often quite easy to see how the winds deviate in the valleys and glens; in fact, the dust-haze was sometimes so thick that for a short period the air was quite darkened by it. Here however, in contrast with the basin of the Kum-köl, there was no drift-sand, at any rate there was none within sight. Next day the sky was thickly clouded over, but it was not until evening that any snow fell. At two o'clock we had a storm from the west. By this we had again reached drier regions, for in the Atschik-köl basin the surface was nowhere marshy.

This locality was frequented by large numbers of kulans, orongo antelopes, and wolves.

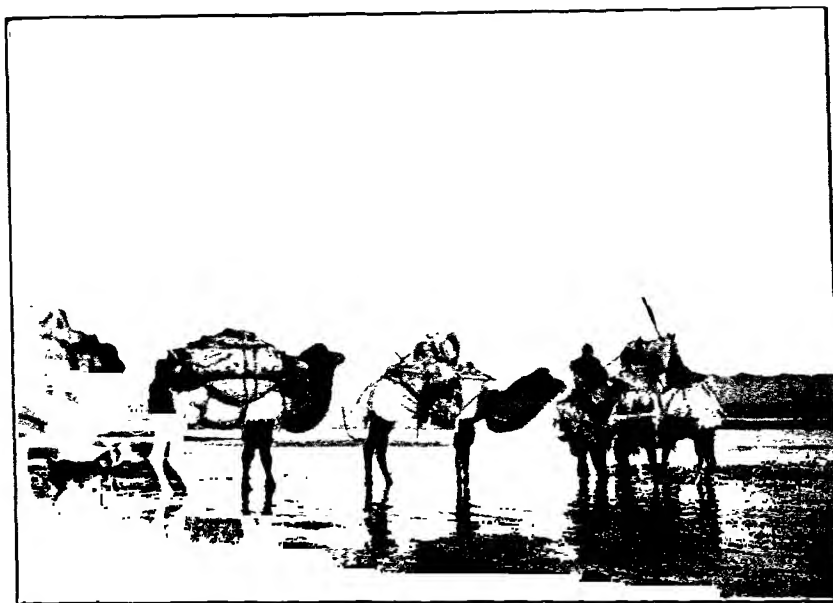


Fig. 132. SOME VIEWS OF THE RIVER OF ATSCHIK-KOL.

October 5th. Immediately after leaving camp we forded the stream that flows down into the lake from the west; it was there 34 m. broad, and had a mean depth of 0.25 m., a velocity of 0.65 m., and a volume of 5.5 cub.m. in the second. It was full of ice; but the morning being sunny, the ice was soon loosened from the banks after the river began to rise, as we distinctly saw it doing in the branches and side-arms which it forms just there on both sides. It is only occasionally that the river is collected into one single channel; it is generally divided into two or more arms, all shallow, and flowing round flat mud-banks. The bed consists entirely of hard, firm clay, without any admixture of gravel. Strange to say, there were no traces of the formation of erosion terraces, at any rate at the spot where we forded the river. The stream flows quite on the surface in a slight hollow drawn across the plain, and one naturally asks, how it is that the great volume of water — and in the summer it must make a flood of very considerable magnitude — has not succeeded in scooping out for itself a more distinctly marked channel.

The water is almost everywhere clear. The river flows pretty straight towards the lake, without describing any wide curves; but the lake was no longer vi-

sible. At a considerable distance north of this river we forded four other watercourses, the biggest of which had a volume of 2 cub.m. in the second. These came from the north-west, flowing out of the range that borders the lake-basin on the north. The locality in which they appeared more especially to originate is that

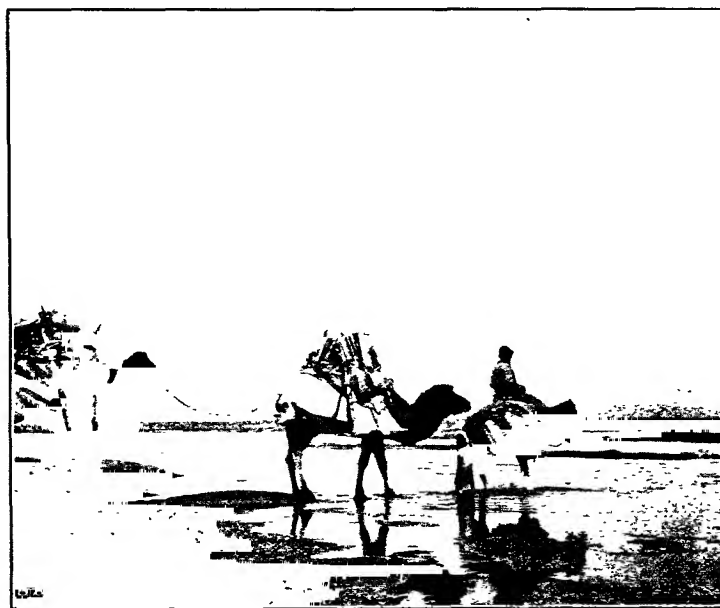


Fig. 133. SOME VIEWS OF THE RIVER OF ATSCHIK-KÖL.

around the peak A 3, though this I was not able to determine with certainty. Between the river and these four streams, which probably unite before they enter the lake, there are several other watercourses, then dry and very shallow, and the country adjacent presented clear evidences of having been under water for a broad stretch

in the summer; for it was still moist and marshy to a great distance from the stream and the ground consisted of a deceitful yellow clayey mire. The country here was remarkably flat, and in crossing over this broad latitudinal valley in a diagonal direction, as we were doing, it was impossible to detect either slope or undulations. The shape of the valley bottom explains the absence of erosion-terraces beside the

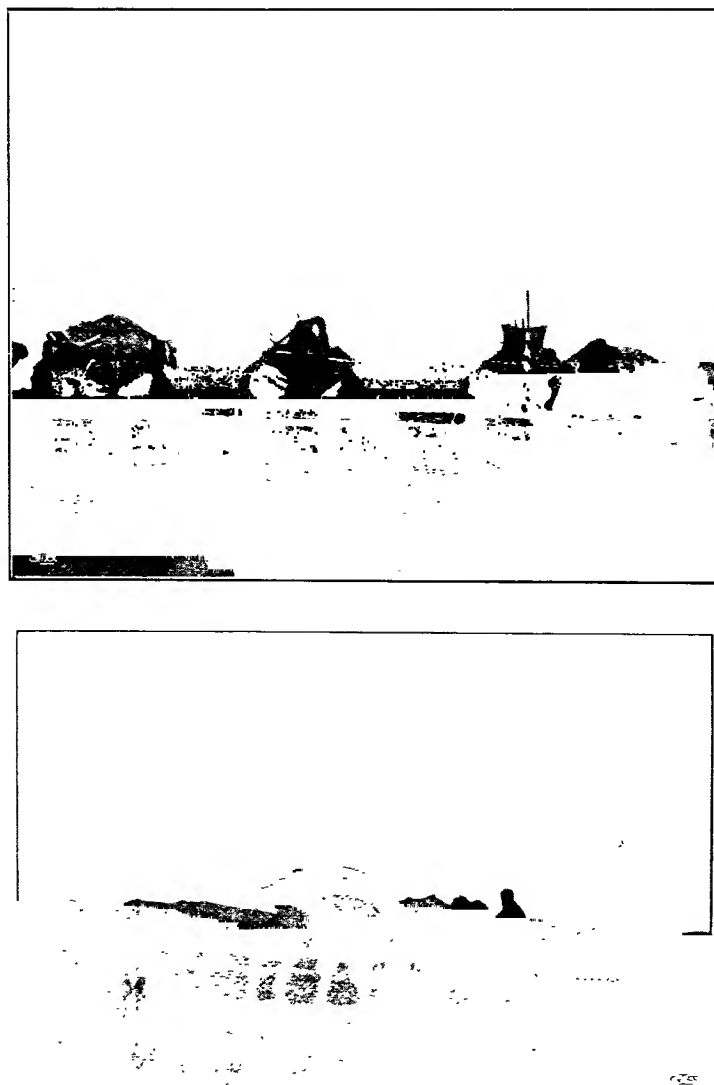


Fig. 134. SOME VIEWS OF THE RIVER OF ATSCHIK-KOL.

river. In the height of summer, when it would be utterly impossible to cross this valley, its lower section is in great part inundated; perhaps the western shore of the lake reaches then all the way to the vicinity of Camp LXV. The shape of the basin throughout points to the lake being unusually shallow, so that but a slight rise of its surface must be followed by an incomparable enlargement of its area. It is owing to these facts, that the river spreads out over a great part of the valley and then in the autumn withdraws into the shallow bed in which we found it, that it

enjoys no opportunity of creating erosion terraces, but expends its energy instead in sedimentation and in levelling up.

We were travelling north-north-west, making for a gap in the crest immediately west of the snowy peak C<sub>3</sub>, where there appeared to be a pass. After cross-

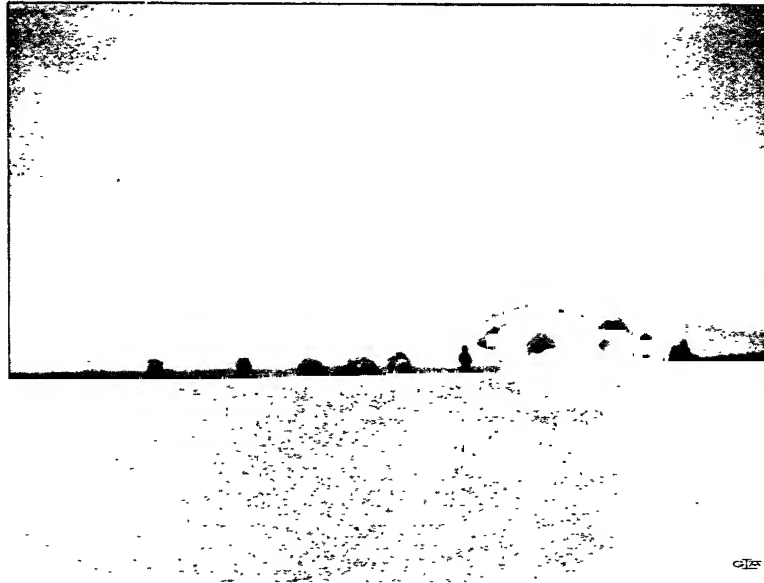


Fig. 135. ON THE ROAD TO THE NORTHERN BORDER-RANGE OF THE ATSCHIK-KOL-BASIN.



Fig. 136. GRAZING ON THE ROAD.

ing the last of the watercourses, we entered upon a gently rising *saj*, almost entirely barren, and strewn with fine débris, but without rainwater rivulets. It was not until we reached two chains of low hills a good bit farther on that we came across the next watercourse, and it was perfectly dry. On the other side of it the *saj* continued

again, though diversified by an occasional patch of grass. To the east we perceived a buttress or supporting ridge of the range which we were then approaching. South of it the country was extraordinarily level and open towards the east, while the great valley extended westwards for as far as we were able to see. In this latter direction there must however be a low flat swelling or saddle, the water-divide of the latitudinal valley and the western boundary of the Atschik-köl.

We gradually made our way into the mouth of a trumpet-shaped eroded water-course, dry and flat; though a small spring gushed out on its brink at an altitude of 4548 m. The grazing here, although scanty, was better than in any part of Tibet that we had recently visited.



Fig. 137. A DEAD ORONGO.

We saw hard rock nowhere, though at Camp LXV there were one or two small outcrops of fine-grained conglomerate, sticking up out of the ground.

The weather was bright and fine, with the exception of a short, but violent, storm from the west, accompanied by fine drifting snow.

October 6th. We continued to ascend over moderately hard grass-grown ground between two dry watercourses. The pass appeared to be quite close as well as easy, but we soon learnt that we were separated from it by some as bad ground as it is possible to conceive. The peak C<sub>3</sub>, which rose to the north-east of us, stretches away to the south-west and south-south-west in a rounded curve. Its flanks are scored by a great number of deep ravines (fig. 138), with perpendicular sides; and it was only by making use of the beds of the small side-torrents that we were able to travel across this peculiar country. The formation is exclusively gravel-and-shingle and deposits of red sand, gravel, and soft earth. At length we struck into a larger water-course that led straight up to the pass; and although it was dry, it contained some scattered sheets of ice. The peak B<sub>3</sub> and the crest of the range to which it belongs



were now visible in foreshortened perspective in the west, while the peak C<sub>3</sub> was on our right. The basin of the Atschik-köl lay behind us, shrouded in mist, and the crest of the Arka-tagh was no longer visible.

At length we reached the pass (alt. 5143 m.). I can only pronounce it too difficult a pass for our caravan after it had spent three months in Tibet. From its summit a panorama of mountain-peaks and ranges was now unfolded to our gaze. In the west

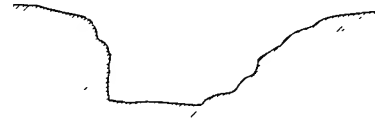


Fig. 138. VERTICAL SECTION OF A RAVINE.

and north-west was a massive spur which B<sub>3</sub> thrusts out towards the north, and between us and it were several similar spurs all parallel to one another. Afar off in the north was a range that runs east and west. From our then point of vantage it was not possible to obtain with any degree of clearness an insight into that chaos of mountains, that labyrinth of glens and valleys. Just east of the pass we discovered two very large, though short, truncated glacier-arms, descending from C<sub>3</sub> towards the north-west. The northern acclivity of the pass is pretty steep. In the little glen in which we pitched Camp LXVII (alt. 5108 m.) there was neither grass nor fuel nor water.



Fig. 139 ON THE PLAINS S. E. OF ATSCHIK-KÖL.

Not far north of Camp LXVI a small rib of sandstone cropped up out of the ground at an inclination of  $74^{\circ}$  N. In the vertical sides of the deep ravines sections of argillaceous schist and conglomerate were exposed here and there, at first at an angle of  $56^{\circ}$  W., but later with a dip of  $57^{\circ}$  towards the N.  $25^{\circ}$  E. Amongst the débris with which the watercourses were choked was also some granite, and it is of granite that the strata of gravel-and-shingle essentially consisted. Nevertheless we saw no hard granite rock all day long; but no doubt the peaks B<sub>3</sub> and C<sub>3</sub> are built up of this rock. Immediately south of the camp we found a reddish schist, dipping  $51^{\circ}$

towards the N.  $38^{\circ}$  W., and on the pass itself the same formation dipping  $10^{\circ}$  towards the S.  $60^{\circ}$  E. Immediately north of the pass we saw no hard rock, but the débris was composed of the rock that I have last mentioned and of granite.

Thus we had at length crossed over the range that fences in the basin of the Atschik-köl on the north. In its broad features the architecture of this basin is the same as that of all the self-contained basins which we have lately visited in north-western Tibet; that is to say on the north and south it is bordered by parallel ranges and east and west by flat swellings, forming the water-divides in the latitudinal valley in which the salt lake is situated. Generally speaking, the basins on the Tibetan plateau are elongated from east to west; but the basin of the Atschik-köl appears to be on the whole more circular. According to Roborovskij's map, the lake itself is also round, and not drawn out to east and west like the lakes on the Tibetan highlands.

With the view of enlarging our survey of this region, it will be interesting to quote briefly Roborovskij's experiences. During the Pjevtsoff expedition in 1889—90 Roborovskij made an excursion from Mandarlik on the upper Tschertschen-darja eastwards to the Ajagh-kum-köl and in the course of it discovered the Atschik-köl. His description of this is very instructive, even though his orography is in some points not quite accurate. He started from Mandarlik on the 15<sup>th</sup> 27<sup>th</sup> of August, so that he reached the Atschik-köl about a month earlier than I did, that is taking note of the year only.

Leaving the Tschertschen-darja immediately above Mandarlik, he proceeded up its tributary, the Musluk-su, in a south-eastern direction, until he reached a secondary pass, 15,500 feet high. The glen by which he ascended was narrow and filled with débris, and towards its head the ascent was very steep. On his map he gives to this pass the name of Musliknin-atasi-daban (the Pass of the Father of the Ice-Region), but in the text he calls it Musliknin-atasi. The latter is the more correct form, though it ought to be written Muslukning-ajtuse, that is the Pass of the Ice-Region. On the east side of the pass he descended to the Ullugh-su, the true head-stream of the Tschertschen-darja. This stream flows there at the bottom of a deep glen and, going northwards, pierces the range which Roborovskij calls the Muslik-tagh, and which is identical with the range that we crossed over between the peaks B<sub>3</sub> and C<sub>3</sub>.

The Ullugh-su is formed by the confluence of the Patkaklik-darja, from the south, and the Akka-taghning-su (= Arka-taghning-su), from the south-east, both streams originating in the Arka-tagh. He followed the latter up towards the south-east, having on the north the long and gentle slopes of the range through which these streams cut their way and on the right the Arka-tagh (Prschevalskij Chain), with its immense snow-fields. Leaving the Arka-taghning-su on the right, that is on the south, he continued his journey towards the east, across a plain that was soft and in places marshy. To the north-east rose the snowy mountains of Ajajalik-tagh.\* On the way he crossed over a number of brooks, flowing towards the north and entering the large river of Atschik-kölning-kojasi,\*\* which discharges into the

\* This name seems to be incorrectly spelled. It ought probably to be Ajaghlik-tagh, or the Lower Mountains, in contradistinction to Arka-tagh, mountains which are in reality higher.

\*\* Kojasi ought probably to be Kujuschi = Confluence.

Atschik-köl — a stream identical with that on the right bank of which I pitched Camp LXV. The region abounded in kulans and orongo antelopes, as in October. Continuing farther in the same direction, he travelled to the small foot-hills of Karadgo-kum-bujun,\* the extreme outlier of the Arka-tagh towards the large open basin.

In its lowest reaches the stream is joined by several tributaries and there are in this part a great number of small pools. The sandy western shore of the lake was in many places marshy, and it proved to be impossible to get round the lake by the west and north. The lake also receives another stream coming from the south-west and called on the map Ajgin-utagnin-su; it is there shown as quite short and as though it issues out of the extreme northern outliers of the Arka-tagh. As a matter of fact, it is identical with the river beside which we made Camps LXIII and LXIV and which breaks through two ranges that run east and west.

Roborovskij gives the following information with regard to the lake: »The Atschik-köl is pyriform in shape, and sends out a blunted bay towards the north.\*\* In circumference it measures about 75 versts and its greatest breadth is 25 versts. Its shores, with the exception of that on the south, are very flat, greatly impregnated with salt, and in places marshy, especially on the west, where are the arms of the Atschik-kölning-kojasi and Ajgin-utagnin-su, as also a number of minor feeders and the tiny lakes to which they give origin. The southern shore is however high, and is accompanied by a rampart of sand. The offshoots of the range on the south, some of which reach right down to the lake, form three rocky islands close to the shore. From the eastern end there projects out into the lake a narrow tongue of land about 6 versts in length; and a similar tongue of land juts out from the northern shore, forming a large bay. The water in the Atschik-köl is salt.»

From the lake Roborovskij travelled on due east, crossing over the northern spurs of the Arka-tagh, with a broad valley between them. Here too he crossed the water-divide between the basins of the Atschik-köl and the Ajagh-kum-köl. From Roborovskij's description it is evident that the eastern water-divide of the basin is a more pronounced feature than the western. With regard to the latter he says nothing direct, but the map shows where it lies between the rivers, although there is no indication of any elevation of the ground. From this it is to be inferred, that the western water-divide is particularly flat, possibly it is not even evident to the naked eye. The same thing has been observed scores of times on the Tibetan plateau. Roborovskij's description of his route gives a clear picture of the morphology of the country, and it agrees admirably with the observations which I myself made along the itinerary I took through the same basin, my route cutting his at

\* The word Karadgo is unintelligible. Probably the guide who gave him the word was suffering from a cold and pronounced an *n* as if it were a *d*. Karango-kum-burun is a more likely form, and would mean the Cape of the Black Sand. The name points to the presence of an expanse of sand, although the text says nothing about any such expanse.

\*\* To judge from the map it is circular rather than pyriform. I venture to think however that as an actual fact it is elongated in the same way as the Ajagh-kum-köl, for if the lake has a diameter of 20 to 25 versts and its northern shore is very flat, Roborovskij, who travelled on the southern shore, would not be able to see the opposite side of the lake. As however he distinctly saw, not only the northern shore, but also its blunted bay, the lake must measure a good deal less from north to south than it does from east to west.

right angles just west of the lake. On the other hand his account of the grouping of the mountain-ranges is inaccurate. Let us take first the mountains on the north side of the basin of the Atschik-köl; there Roborovskij has entered on his map no less than seven parallel ranges, all stretching from the north-west to the south-east. The highest lies farthest to the north-east, namely the »Ajajalik-tagh«, which is represented on the map as being covered with fields of perpetual snow, crowning the crest to which my peak A<sub>3</sub> belongs. The chain farthest to the south-west is quite short, and rises on the right bank of the Arka-taghning-su. On the right bank of the Ullugh-su there is a meridional range, and from its eastern side five of the seven chains proceed. From the point of view of orography and erosive action this arrangement is absurd as well as inconceivable; besides, the traveller did not see all these ranges, and consequently ought not to have entered them on his map. West of the Ullugh-su he shows the range of Musluk running east and west. Now there cannot be the slightest doubt that the »Ajajalik-tagh« is the eastward continuation of this same Musluk, so that instead of the seven ranges mentioned we have only one culminating range, which stretches from west to east until it dies away in the region north-east of the lake, a range that lies parallel to the Arka-tagh and a host of other ranges in northern Tibet. Possibly, like the Arka-tagh, it may have one or more subsidiary chains of foot-hills; but any way it must be regarded as a distinct and separate range, quite as much as the Arka-tagh is.

The range that bounds the basin of the Atschik-köl on the north is cut at right angles by the deep transverse glen of the Ullugh-su or upper Tschertschen-darja. By following this glen upwards Roborovskij escaped crossing the range by a pass, though I crossed it by a pass between B<sub>3</sub> and C<sub>3</sub>. In consequence of this he did not enjoy such an excellent opportunity as I did to study the broad features of the orographical structure.

Thus we find the same faults in Roborovskij's map of the country south of the Atschik-köl that we have already noted in his map of the Arka-tagh in the region around Schapka Monomacha. He depicts the former as a very straight and regular main range throughout; such does exist of course, and it is not in that that the errors complained of are to be discerned. But he shows fully a dozen spurs and offshoots jutting out from this range towards the west-north-west, and gives a length of not less than 170 km. to the longest of them, which rests its western extremity upon the river and thence sinks down to the Atschik-köl. It is these spurs and offshoots that appear so very absurd. In reality they have no connection with the Arka-tagh, for its northern offshoots are short and meridional, while the ranges to the north of them run east and west and are in several places pierced by the streams of the Arka-tagh, these last terminating, some in the valley of the Atschik-köl, others in the basin of the Kum-köl. Apart from these orographical mistakes Roborovskij's reconnaissance of this region is especially instructive and valuable.

October 7th. We now travelled away from the snow-clad spur west and north-west of Camp LXVII. There was a gap in it, which appeared to promise a pass, possibly a water-divide between some of the tributaries of the Tschertschen-darja and the Toghri-saj, which we were now approaching. At first we bore to the east, travelling across rounded ridges of débris, bordered by deeply trenched

gorges, then quite dry. A few patches of snow still survived. We were now quite close to the face of the glacier-arm of C<sub>3</sub>, with its rather large terminal moraine, extending fully 300 m. in front of the actual glacier and embracing in its mass some very large blocks of granite. In this way we travelled north of the peak C<sub>3</sub>, which is on that side covered with snow and sheeted with ice. North-eastwards this peak is continued by an imposing range, which we had long had on our right. From the valley we were unable to decide how far this was a continuation of the main range to which the peaks A<sub>3</sub>, B<sub>3</sub>, and C<sub>3</sub> belong, but probably it is such a continuation.

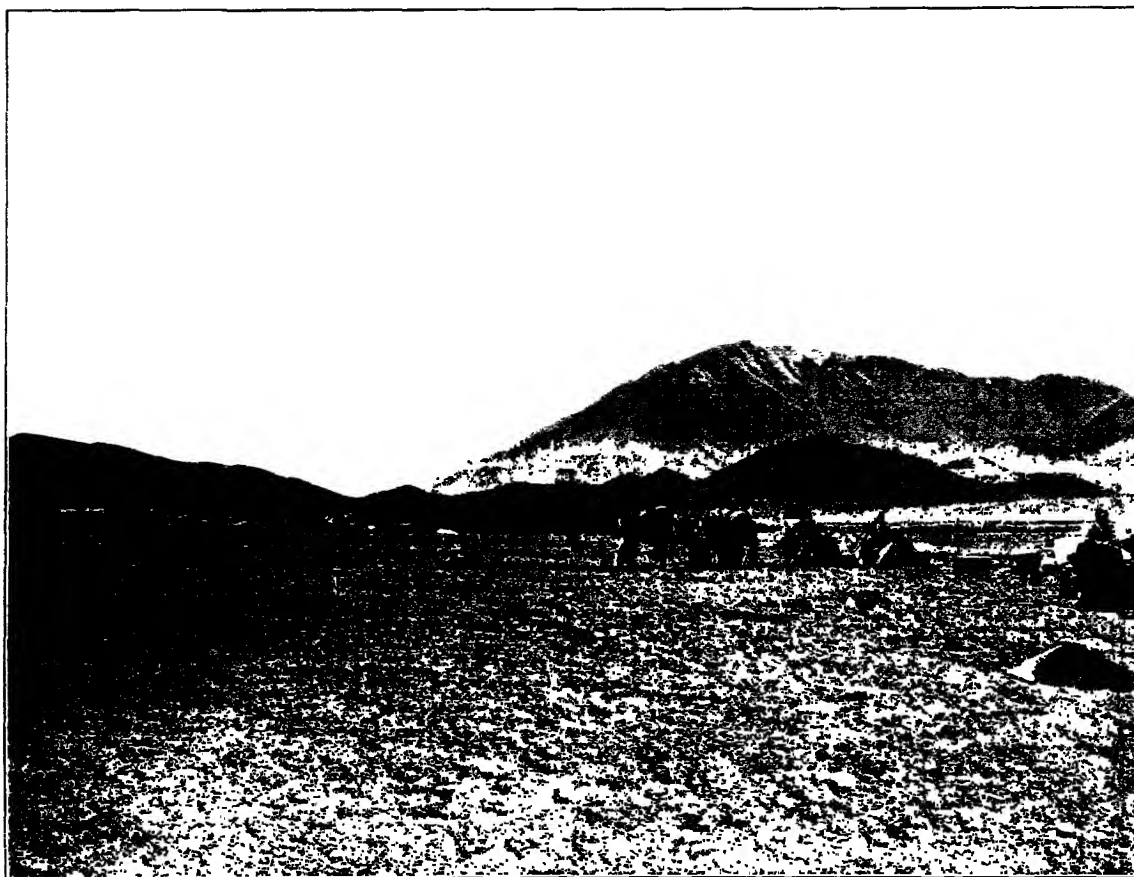


Fig. 140. LOOKING UP TOWARDS C 3 FROM CAMP LXVIII.

After crossing over a great number of torrents in the open valley that forms the real source-region of the Toghri-su, and then descending its slopes, we reached the principal valley, down the bottom of which flows a small brook, then everywhere frozen. The water-line showed distinctly that in the height of summer the stream swells to formidable dimensions, and the impression was confirmed when we cast a glance up the valley, and saw how the streams of thaw-water and spring-water gather off a circle of snow-clad mountains and crests, and converge upon the principal glen in which we then were. To the left, that is the north-west, our glen is bordered by a range of medium size without snow, and in its upper part it appears to be pierced by one of the

spring-fed streams of the glen. The peak B<sub>3</sub>, which we no longer saw, sends off several large snowy ranges, the disposition of which, from the place where we were travelling, it was impossible to make out. To the north-west, beyond the nearest range on the left side of the valley, we perceived an imposing mountain-range, almost entirely covered with snow. This I took to be Prschevalskij's Moskovskij Chrebet, and one of its prominent peaks was that which he calls Kreml. To the south-east, beyond the range C<sub>3</sub>, we saw another, but flatter, range. Had we chosen a pass to the east of the peak C<sub>3</sub>, we might possibly have crossed over the northern border-range of the Atschik-köl basin at a far easier spot than that by which we actually did cross it.



Fig. 141. VIEW LOOKING NW. IN THE BACKGROUND THE MOUNTAIN-MASS »KREML«.

All day our glen, the upper part of the Toghri-saj, sloped very gently down towards the north-east: one would have to travel a great distance in that direction before getting down to the level of the Atschik-köl. The bottom of the glen is plentifully strewn with débris and perfectly barren, though lower down we came in a few places across tiny mosses, cautiously sheltering themselves between the stones and the gravel. There were no traces of wild animals, except that at Camp LXVIII (alt. 4795 m.) we saw the droppings of kulans.

In narrow places, where the stream closely hugs the face of the granite cliffs, the bottom of the glen is choked with fragments of that rock as much as 1 cub.m. in magnitude. These, being water-worn, were rounded like eggs or balls. Even

thus early the idea suggested itself, that this route must be impracticable in summer, for in places the stream must then wholly fill the bottom of the glen. For this reason the gold-miners, who work at the mines lower down in the same valley, usually travel to them in the autumn, when the river has dropped sufficiently.

Granite was now predominant everywhere. Still there must be also a fine-grained, extremely hard crystalline schist somewhere in the hard rocks, for the débris in the bottom of the glen contains fragments of such intermingled with the granite, although in far smaller quantity. All the way down the glen the cliffs were composed of a yellowish or pinky granite, and at Camp LXVIII the granite formed a vast talus slope on the right side of the glen. This granite region is rich in wild, craggy scenery — fantastic outlines, imposing masses and spurs of bare rock, dome-shaped, compact, and extremely rugged pinnacles.

October 8th. Toghri-saj, with its deeply accentuated glen formation, is indeed a remarkable phenomenon. It resembles a gigantic conduit, placed close to the west



Fig. 142. TOGHRI-SAJ.

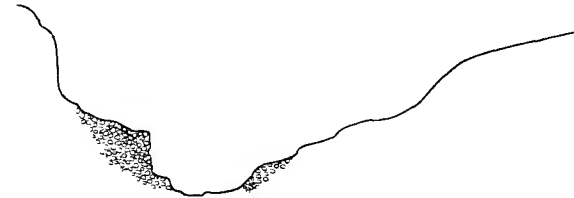


Fig. 143. TOGHRI-SAJ.

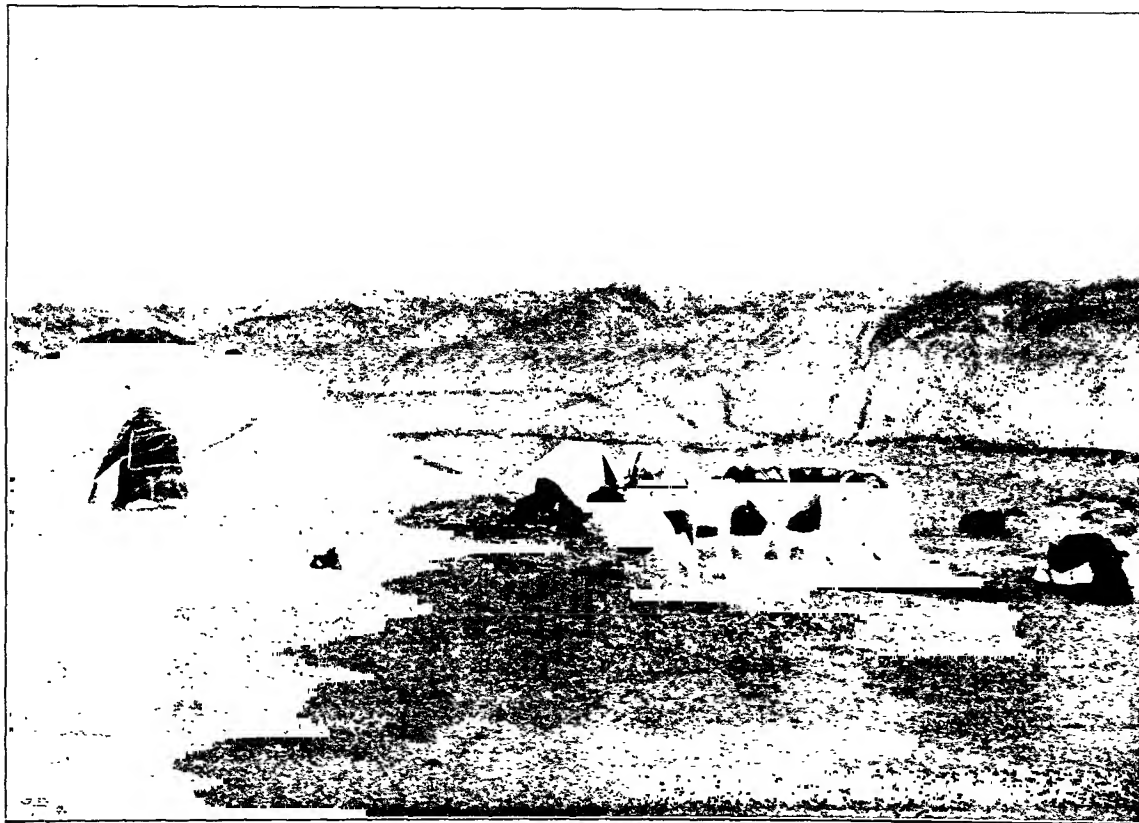


Fig. 144. CAMP LXIX.

border of the vast open basin between the mountain-systems of the Tschimen-tagh and the Arka-tagh, a basin that is divisible, as we have seen, into the two self-contained basins of Atschik-köl and Kum-köl. On the other hand the drainage area of the Toghri-saj belongs to the Tschimen-valley, a third self-contained basin. On the west the region of Toghri-saj is bordered by immense offshoots from the region of the Tschertschen-darja, a region that forms part of the vast basin of East Turkestan or Lop-nor.



Fig. 145. MOUNTAINS ON THE LEFT SIDE OF THE VALLEY. CAMP LXIX.

I will now proceed to describe the glen of Toghri-saj and then endeavour to ascertain its position in relation to the mountains that lie nearest to it.

From Camp LXVIII, where the first wretched grass occurred in the glen, we proceeded towards the east-north-east. The glen is here broad and open; the surface is hard, being composed of fine consolidated material, with a little grass growing at intervals on gentle eminences. Small subsidiary glens join it from both sides. A dark mountain mass on the left forces the glen to turn to the east-south-east, but after two or three bends it again resumes its north-east direction. Beside the dark mountain-mass our glen is joined on the same side by a particularly large glen, which actually looks as big as itself. At the point of junction there is an expansion with good grass, and it was here we came upon the first three stone huts; they consisted simply of four square low stone walls, with a door-opening, but no roof.



At the point where the glen bends to the north-east, it contracts to the semblance of a wild and deep-cut transverse glen, a veritable gorge, grander and more picturesque than any other glen I have seen in that part of Asia, wilder in fact and more rugged than the transverse glens of Dalai-kurghan and the Tscharklik-su. For our exhausted camels this proved an exceedingly tiring bit of road. To go down it was difficult enough; to have attempted to climb up it would hardly have been possible with camels. Excessively narrow and carved to a great depth through the granite cliffs, it makes numerous short bends and windings, and to make matters still worse, its bottom is choked with water-worn blocks that have fallen from the crags above, and in some places are piled up to a great height. In and out amongst these masses of rock winds the stream, although its volume was then hardly bigger than  $\frac{1}{2}$  cub.m. in the second, and it was moreover frozen completely over, the ice being strong enough to bear the weight of our camels. The only places where the current still trickled was down the steep declivities and where the velocity was greater than usual. The only part of the glen along which we were able to march with our camels was in the actual stream, though the gold-miners, who travel with asses, are able to get along on the sides of the talus slopes. Now the granite cliffs drop by fantastic steps to the bottom of the glen, now the brook is fenced in, sometimes on one side, sometimes on both, by scarped terraces of gravel-and-shingle (fig. 143). Occasionally there is a little expansion with a fairly level floor. The glen is throughout destitute of vegetation. It was only in its upper part that we found a little grass and traces of kulans and antelopes; these animals never venture into the lower parts of the glen, for it is visited every year by human beings. On the whole the glen has an extremely gentle slope, though towards the end of the day's march we found some steep steps below the gravel-and-shingle terraces, especially on the right side of the glen.

About half-way down we saw on the right, that is to the south-east, beyond and over the top of the spur that shuts in the glen of Toghri-saj, a range of moderate dimensions, in part covered with snow and without any upstanding peaks. In the opposite direction, to the north-west, we saw no range, although there no doubt is one. The cliffs that fence in the glen of Toghri-saj on that side are precipitous and wild, and are pierced by steep rugged transverse glens, filled with fallen detritus. Camp LXIX had an altitude of 4515 m.

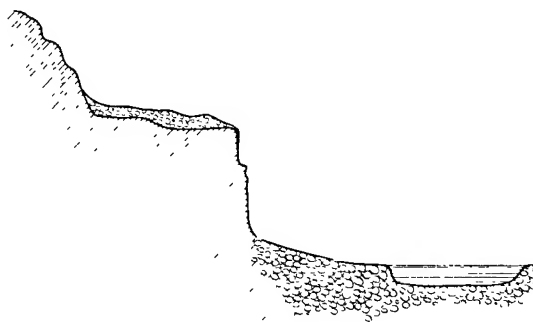


Fig. 146. VERTICAL SECTION OF THE TOGHRI-SAJ.

Granite predominated all day, and was of endless varieties, mostly beautiful fine-grained grey, but also red, pink, flesh-coloured, green, and light green. Besides granite there occurred also conglomerate, crystalline schist, and porphyry.

It is in the narrowest part of the glen of Toghri-saj that the gold-mines are situated. They are visited every year by a number of gold-miners from the south-east of East Turkestan. Two of my men, who had themselves formerly visited the spot on that errand, professed to be able to estimate the number of miners who had

been working there recently; they put it at between 30 and 40. They declared that these men had set off for home about 20 days previously, or about the 20th September, when the autumn begins to feel chilly and the grazing in the vicinity, upon which they feed their asses, is very nearly all finished. The miners seldom stay there longer than a month. They carry flour with them on their asses, and there are generally one or two *pavans* («hunters») in the company, who provide the rest with kulan or antelope meat, and in that way earn their own living. In four different places in the glen we found small «villages» with mines all round them. The huts are built of gravel-and-shingle, that is to say walls are erected of this material, either

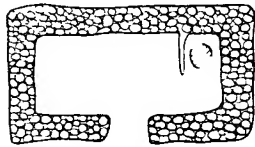


Fig. 147. GROUND-PLAN OF A HUT.

square or oblong in shape, but without any binding material between the separate blocks of stone. They make a roof out of a piece of linen which they bring with them, and if necessary they support it by a pole placed across from the one wall to the other. These huts are very small, the sides not more than 2 or 3 m. long. In one corner there is a fireplace for baking bread. In only two of the huts did we find utensils left behind, — rakes with which the stones are separated out, a barrow in which to carry away the rubbish after it has been examined, a trough for baking, or possibly for washing the auriferous sand in, and some spars for holding up the roofs of the tents. The huts form a mosaic of walls and heaps of rubbish, in and out amongst which run narrow foot-paths. They were like the ruins of a burnt-out homestead, of which nothing is left except the mere shells, forming a veritable labyrinth of stone. The respective claims are marked off by a couple of stones set up on end and leaning one against the other. *Nischans*, that is to say marks, consisting of the skin or skull of a kulan or antelope, are employed to indicate ownership of a mine or working, in which nobody may dig except the man who erected the *nischan*.



Fig. 148. VERTICAL SECTION OF A HUT.

A very short distance below the sharp bend in the glen, where the first huts stand, we observed, among the débris of the gravel-and-shingle on both sides of the brook, a number of workings or pits surrounded by long lines of heaped up stone and rubbish. And as we travelled down the glen we counted thousands of workings. In shape they are quite different from those which I had previously seen at Kapa. In the latter locality they form deep vertical holes; here on the contrary they form wide cavities, seldom more than  $2\frac{1}{2}$  m. deep, most frequently less than that. By far the greater number of these workings were abandoned long ago, and only a few bear indications of having been recently excavated. The gold, which occurs as small round, flattened particles, is sought for in the deposits of sand, gravel, and small fragments of rock that have accumulated in the bottom of the glen. It is through these that the river has carved out its bed, so that it is here inclosed between sharply outlined scarped precipices. It is on the flat top of the escarpments sometimes also a little below them, beside the bed of the existing stream, that the «mines» (*kan*) are dug. Nearly all of them are however so situated that they are safe above the reach of the water, even when the torrent is in flood. Sometimes we

may observe in the face of the hard granite one, two, or even three shelves or steps, indicating former levels of the bed of the torrent, which have been more or less loaded with débris produced by subsequent weathering above, and in this débris also *kans* are dug (fig. 146). When the deposit of débris rests directly upon the bare rock, the miner has to dig right through it, and then most likely finds the gold at the very bottom. All the coarser material is removed simply by hand, being flung up on to the surrounding heap of rubbish, though spades and pickaxes are also employed. The yield is said however to be rather poor, and it is seldom that the miner earns enough to repay him for his trouble. Professional miners are accustomed to visit the mines of both Toghri-saj and Bokalik during the course of the same summer. If the results at the one place prove disappointing, better luck is hoped for at the other.

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## CHAPTER XII.

### FROM TOGHRI-SAJ TO TEMIRLIK: ROCK PICTURES.

October 9th. A little way below our camp the glen inclines to the east, and at the same time grows broad and open. Down the middle of it wound the ice-bound torrent. Although the glen still continued to be filled with detritus, travelling was not so difficult. Beyond the spur on the left side of the glen rises a considerable range, crowned by two dome-shaped snowy peaks. The mountains that now inclosed the glen on the right were fairly low.



Fig. 149. VERTICAL SECTION AT CAMP LXIX.

The entire region was painfully destitute of vegetation; soft ground there was none whatever. It was only after we turned the next elbow, and the glen assumed a more northerly direction, that we found a little wretched grass. A multitude of dry torrents, with which the detritus at the bottom of the glen is furrowed, indicate that the summer flood must be especially large; in fact it must grow bigger as it rolls down the glen, for it is joined by several tributaries as it proceeds. Three of these side-glens are particularly large, and two of them seem to issue from the recently mentioned snow-clad peaks.

At Camp LXIX we observed three very distinct superimposed terraces. The lowest is about 12 m. thick (or deep), the middle one 7 m., and the uppermost one 15 m. (fig. 149). On the left side of the glen the two top terraces are composed entirely of detritus and gravel-and-shingle, while the bottom terrace, which forms an almost perfectly vertical wall, and is directly exposed to the erosive action of the torrent, consists of hard rock, namely greenstone. All day these three terraces were as a rule severally distinguishable, though occasionally at the bends or angles they become fused into one. Often the green schist crops out in their faces, and often too they are pierced by narrow transverse ravines. At Camp LXIX the green, fine-grained schist cropped out at 70° to the S. 45° E.; at the elbow where the glen bends to

the east, it dips  $60^{\circ}$  towards the N.  $50^{\circ}$  W., the rock being there exceptionally hard and fine of grain. Lower down, near Camp LXX, the dip was  $69^{\circ}$  towards the S.  $60^{\circ}$  W. and  $42^{\circ}$  towards the S.  $5^{\circ}$  W. But between the hard strata there were other green schists of a coarser consistency. Granite was abundant among the detritus, though we nowhere found it in the hard rock. Thus it is only in the granite region that the glen presents the features of rugged wildness and sharply accentuated relief that I have alluded to. As soon as it emerges amongst the schists it broadens out and the slope is more evenly divided.

October 10th. It was not until to-day that we once more got down to the same level that we had been at when beside the Atschik-köl, which proves that the glen has a pretty long and gradual slope. In proportion as we approached lower regions it also grew colder: it was now pretty close to  $-19^{\circ}$  C. In the course of the morning, although the sky was perfectly clear, a furious wind sprang up from the west, and during the day the temperature may have risen to a couple of degrees above zero. At ten o'clock the muddy water was flowing down on the top of the ice that covered the brook, but about a couple of kilometers below Camp LXX (alt. 4352 m.) flowing water and ice both alike came to an end, the water being absorbed by the dry gravelly bed. The quantity of snow also decreased on the summits of the peaks and ranges in proportion as we approached relatively lower regions, where the precipitation is naturally less.



Fig. 150. PLAN OF TERRACES AT A LOOP.



Fig. 151.

The glen continued to be broad and open, and extended in a long, straight line towards the north-north-east (fig. 151). We kept close to the left side of the glen, doubling one green schist promontory after the other. On the right we had a range of moderate altitude and entirely free from snow; but a long way beyond this in the north-east we caught glimpses from time to time of snowy crests, which plainly belonged to the Kalta-alaghan. The range on our left was pierced by a very broad glen, which widened out like a trumpet-mouth as it debouched upon the Toghri-saj. The mountain-chain on the left or north side of this glen is of great size and is crowned with snowy peaks. This side-glen is on the whole narrower, and appeared to be shorter, than the Toghri-saj; but while the principal glen or valley was, as I have said, dry, the side-glen was traversed by a brook of respectable dimensions, which then continued to the north in the united valley. At Camp LXXI (alt. 4067 m.) the stream carried about 2 cub. m. of water, and wheeling round a butte flowed on towards the north-north-west. Here we found, in a little sheltered glen-mouth, better

grass than we had seen for a long time, and japkak also was fairly abundant. Traces of fires indicated that the locality is visited by the gold-miners.

The promontories that we doubled on the left side of the glen consisted of green crystalline schist at  $29^{\circ}$  W., while that which we doubled on the right consisted of the same rock, dipping  $45^{\circ}$  towards the S.  $45^{\circ}$  E. Thus on both sides of the glen the outcrop of the rocks forms dark lines and bands, very distinctly marked; the glen is anticlinal, at any rate in this part. Close to Camp LXXI the dip was  $81^{\circ}$  towards the S.  $60^{\circ}$  E., the rock consisting of a softer, greyish schist, which readily broke into slabs and laminæ.



Fig. 152. PROMONTORY ON THE RIGHT SIDE OF THE VALLEY WITH THE ROCK DRAWINGS.

At the terminus of the glen, that is to the north, there is an exceptionally massive mountain, and to the left of it we saw, a very long way off, a snow-clad crest, which evidently belonged to the Ilve-tschimen. The lower we descended in this broad and sweeping valley the thinner and rarer grew the rock detritus, while on the other hand there was a steady increase in the quantity of the soft earthy ground clothed with grass.

Roborovskij, in the excursion which I have referred to above, travelled from the Ajagh-kum-köl to Toghri-saj, crossing on the way the spur that borders the glen on the east by the easy pass of Kum-bujun (= burun). According to his map, this pass rises only 400 m. above the level of the lake; from which it is to be inferred, that the spur which separates the valley of Toghri-saj from the basin of the Kum-köl is relatively low. Thence he rode up the valley past the gold-mines on his way to Mandarlik on the Tschertschen-darja. According to him the valley of Toghri-saj is situated between the ranges Moskovskij and «Columbus», two names which I hope will be banished for ever from the map. I never succeeded in discovering where the Ajajalik-tagh is, although I did learn that in this same region there is a mountain or



*Ljustr. A. B. Logovtsov & Wafshat.*

MONGOL »OBO» AT CAMP LXXI.





a range known as the Ali-alik-tagh, or the Mountain where Ali Hunted. Probably Ajajalik-tagh is a corruption of this name or, as I said before, of Ajaghlik-tagh, especially as the Russian transcription of the Turkish names is generally more or less corrupt.



Fig. 153. THE SAME.

At the promontory that projects westwards from the ridge on the right side of the glen, and which we doubled during the course of this day's march, we made an interesting and unexpected discovery, namely a rock-drawing in three separate divisions. These drawings have been made on a portion of the light grey-green schists, which have been polished smooth and stained a dark brown colour by wind and weather, and as they were incised, not very deeply, through the harder rock-«crust» with some sharp iron instrument, they stand out clearly and distinctly against the darker background. Some disconnected lines still remaining show that portions of other designs have been obliterated; from which we may conclude that these drawings go back to a respectable age. Of the three divisions (the lower edges of which are about 1½ m. above the level of the ground) the largest is about 1½ m. high, the second 1 m. high, and the third a little less; the largest figures are about 1 foot long. The scenes represented are hunting scenes. On the smallest division or field a tiger-hunt is depicted, from which it may be inferred that the *motif* is derived from the region of the Kara-koschun or the lower Tarim, those being the nearest localities in which tigers are found. The same localities would seem to have supplied the idea for the second scene, a hunter drawing his bow at a bird, probably a wild-duck or wild-goose. The weapons used are in every case bow and arrows, the bow being always at full stretch, and exhibiting a beautiful and complete curve, with the two extremities bent slightly upwards and outwards. The arrows are long, and in the two cases in which they are distinctly seen, they are furnished with three fangs, and thus resemble a Neptune's trident. Prob-

ably the two outside fangs are merely meant to represent the barbs that retain the arrow in the wound. Five hunters in all are depicted, and of these two are on horseback, two are kneeling, while the fifth is on foot with his bow stretched above his head. It is interesting to observe, that in none of the pictures are fire-arms represented; from this we may conclude that these drawings were made at a time when such weapons were not in use, although it is doubtful whether the natives have ever ventured to attack the tiger with a bow and arrows. Moreover there are also depicted a number of other animals, each in a characteristic manner, and although they are shown only in rude outlines, there can in no single instance exist any doubt as to what they are intended to represent. One or two of the smaller animals might, it is true, pass equally well for domestic sheep as for young antelopes; and, curiously enough, a well executed kulan is marked with vertical stripes like the tiger, and consequently resembles a zebra. From the tuft at the end, it is evident that the draughtsman did not intend his drawing for a piebald horse.



Fig. 154. THE ROCK-DRAWINGS.

The left-hand division consists of two sections. In the upper section we have a galloping kulan, a wolf with his tail drooping but curled up at the end, a young antelope, two birds flying, and three yaks, one of which is half obliterated, his head being represented *en face*. In the lower section there are a hunter on foot pursuing a flying bird, another hunter on horseback with both legs on the same side of the horse, and at the bottom an animal grazing, no doubt an antelope. In the middle division we have at the outside on the left a hunter stalking a sheep, and a second hunter, who is intended to be aiming at the two yaks depicted below him. Below the yaks again is an orongo antelope running, easily recognisable by its horns. As regards their shape, these three animals are particularly well done. Above the hunter is a four-legged animal, probably a dog. In the third division the tiger and a man on horseback are depicted. With regard to the former figure there exists

no room for any doubt. The kulan shows, it is true, the same vertical stripes, but the tiger is recognisable from his long tail without any tuft at the end and from his claws.

The question arises, who can have drawn these artistic rock-pictures in this dreary and uninhabited mountain region. Were they Lopliks or gold-miners from the southern Tarim basin? To this question the answer is No. In the first place, these people would never have occasion to do it, and in the second place they would be unable to draw them, for I have never observed amongst them any evidences of a similar artistic skill. Only once have I seen rock-drawings undoubtedly executed by Muhammedans, and they too represented wild animals, namely on the stone Tamgha-tasch beside the Kara-köl in the Eastern Pamir, where Kirgis (Kirghiz) live. But the rock-drawings with which I am now dealing are executed with a much surer eye and greater skill. No, it is more likely that the draughtsman was a Mongol, and that the drawings date back to a time when the Kara-koschun region was inhabited by Mongols, indeed they may even date back to the epoch of the ancient Lop-nor. In any case the hunters are professional hunters, who hunted the tiger in order to sell the skin to the Chinese, as also kulans and yaks, again for the sake of their skins, though no doubt for their flesh as well.

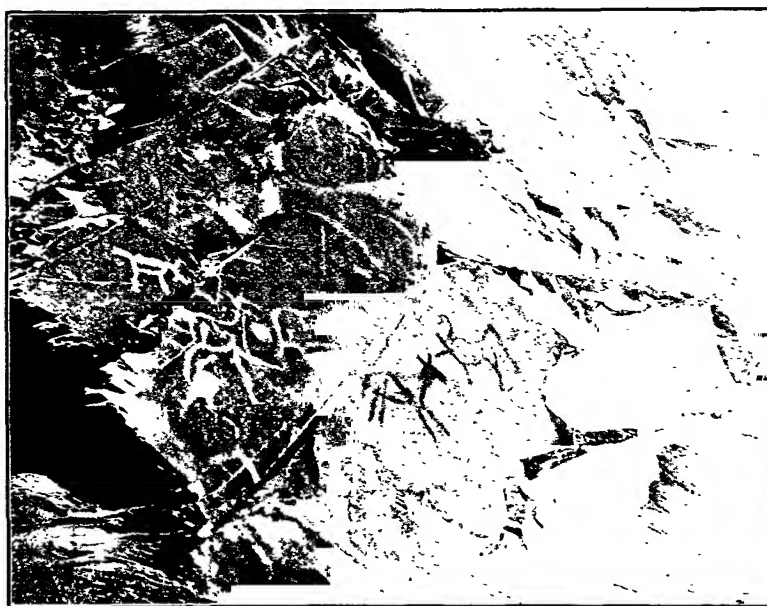


Fig. 155. THE ROCK-DRAWINGS.

And at Camp LXXI we discovered unmistakable evidence that Mongols had indeed visited that region, namely an *obo*, or a group of slabs of schist, propped up on end one against the other, with the inscription 'On mane padme hum' engraved upon them a multitude of times, the letters being of two different sizes. We also came across several similar stones, inscribed all over with the same apostrophe, lying scattered about the flat entrance of the glen around our camp. Here there cannot possibly be any mistake; nobody except Mongols could have prepared these stones,

and every probability points also to the rock-drawings having had the same origin, especially as they have been produced in exactly the same way by means of a hammer and an iron chisel. The slabs bearing the prayer formulæ are precisely like those which I found in the southern border-range of Tsajdam in 1896, especially those in the glen of Ike-tsohan-gol. It is quite clear that neither pictures nor inscribed stones can have been executed by people of a settled race, for even shepherds would be unable to maintain themselves in that almost barren tract. Either they were simply hunters who made the lower Toghrisaj the scene of their operations or they were pilgrims to Lhasa who left here an example of their art. Probably it was the former who in this way perpetuated their hunting exploits and the latter who set up the obo.

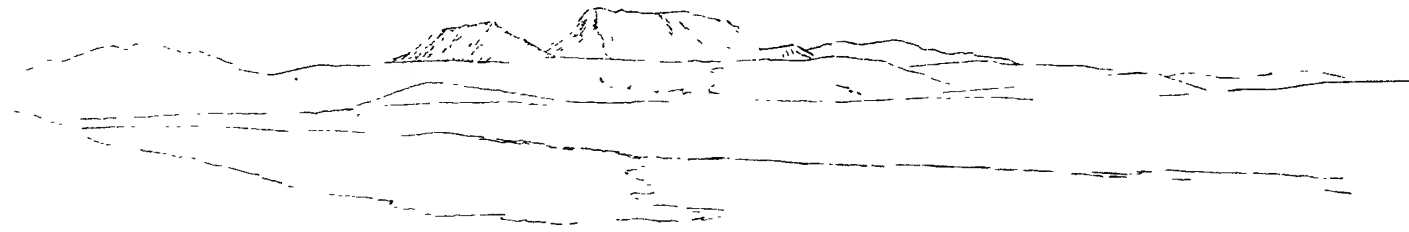


Fig. 156. THE ROCK-DRAWINGS.

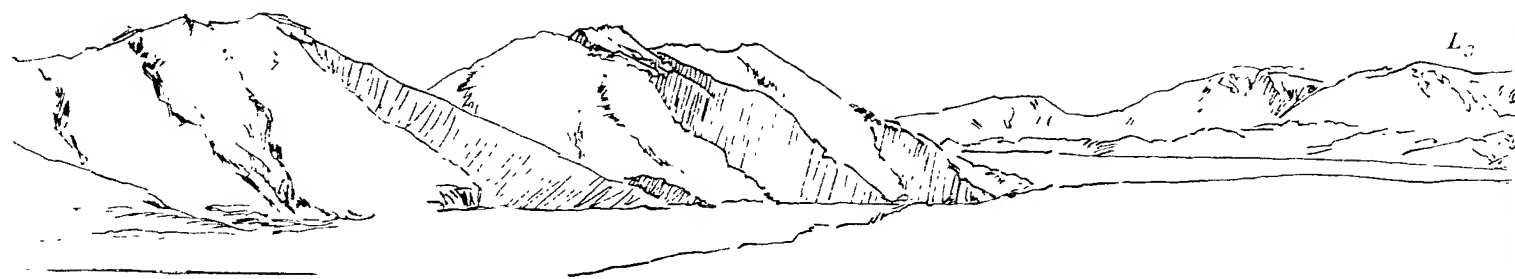
October 12th. At Camp LXXI we once more came into contact with human beings, by meeting a couple of hunters from Tschertschen, who had come up to the mountains to shoot yaks and kulans, for the sake of their skins, which they sell to the Andischan merchants. The nearest route from that spot to Tschertschen passed, they told me, through the following places — Aghatscha-tschat, Kaschätlik, Korumlik, Ghal-saj, Unkurluk, Turdumet-alik, Kosuk-kakti (to which point it is said to be a heavy day's march), Dimen-alik, Basch-malghun, Tokus-davan, Munar-bulak, Kätschik (where the Tschertschen-darja is crossed), and finally Tschertschen, which can be reached in six days. The entire route runs through the western prolongation



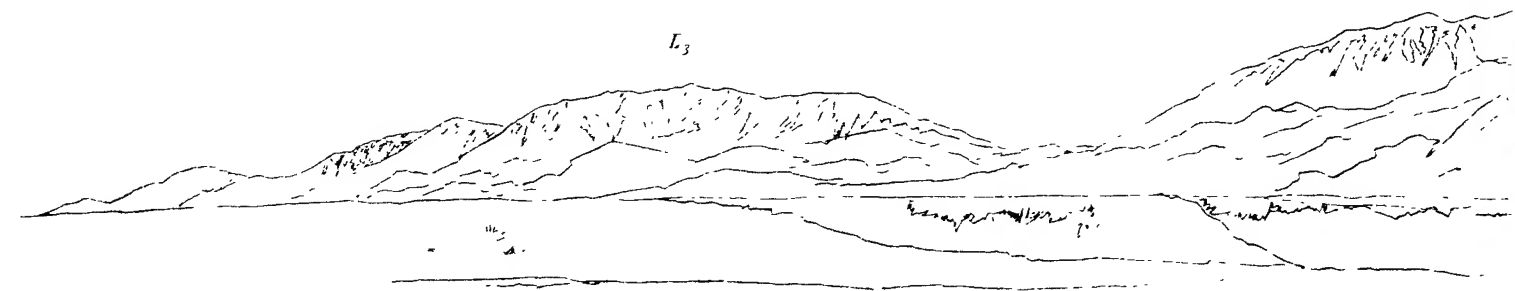
S<sub>1</sub> S + E



View from Camp XLVI



Ive-tsch n from Camp LXXVII

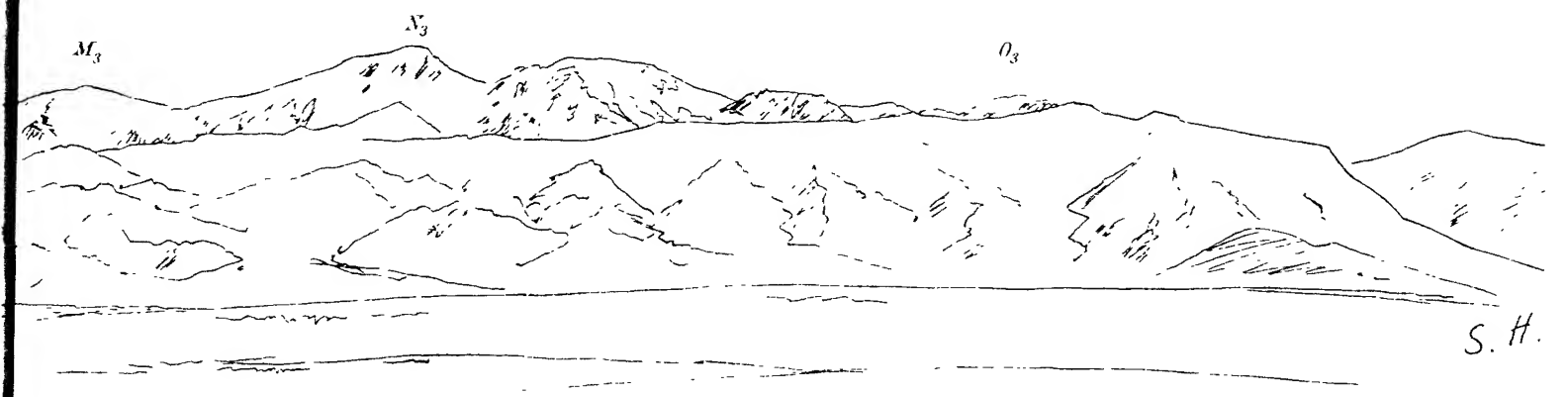


The summits of I tchimien from Camp LXXIII

S + E



The highest summit of M<sub>2</sub> N<sub>2</sub> from Camp LVI Sept 23<sup>rd</sup>





of the Tschimen valley and then down the glen of the Tschertschen-darja, which forms the direct continuation of the valley. On the map of the Russian General Staff we find entered several of these names, as well as two or three that were not known to my informant: the map list is Don-saj (= Dung-saj), Kosuk-kakti, Kara-tschoka, Dimna-lik (= Dimen-alik), Basch-malghun, Mandarlik, Tschoka-davan, and Muna-bulak (= Munar-bulak).



Fig. 157. THE ROCK-DRAWINGS.

The extreme upper end of the valley of Toghri-saj is said to be known under the name of Ajghin-otak.

From Camp LXXI a short cut leads east-north-eastwards to Temirlik across the Piaslik range, the westward continuation of the Tschimen-tagh; this route runs *via* Kum-bulak and Kisil-tschap. I preferred to keep to the valley of Toghri-saj until I came to the valley of Tschimen, my object being to reach good grazing as soon as possible. The brook makes its way by the east side of the little mountain-butte at Camp LXXI. We kept to the west of it, and crossing over an insignificant saddle once more went down into the valley of Toghri-saj, which again contracts to a narrow defile between vertical cliffs. Here too the Toghri-saj is a transverse valley, though not as Roborovskij says between »Moskovskij» and »Columbus» (= Kalta-alaghan), for the Kalta-alaghan does not touch the Toghri-saj at all, but, decreasing in altitude, comes to an end before that. The lower defile of the Toghri-saj pierces the Piaslik-tagh, a range identical with the Tschimen-tagh, which



is here a good deal lower than in the quarter where we crossed over it above Mandarlik.

The stream had now swollen considerably and upon measurement gave the following results — a breadth of 11 m., a mean depth of 0.3 m., and a mean velocity of 1.2 m., consequently a volume of about 3.9 cub. m. in the second. It was excessively muddy and of a reddish brown colour, though along the flat reaches, where the current did not run too strong, there were narrow fringes of ice. This defile cannot match the upper one for wild and rugged grandeur: the road is here

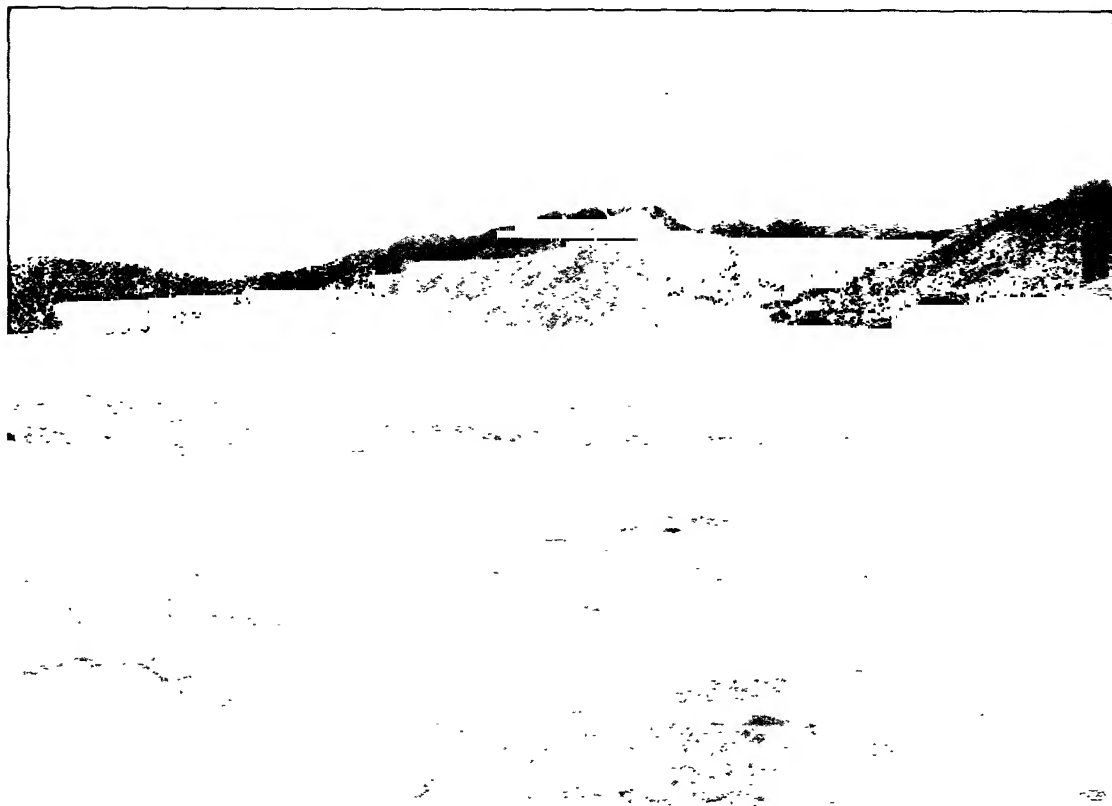


Fig. 158. WESTERN PART OF ILVE-TSCHIMEN FROM CAMP LXXIII.

everywhere easy and we only required to cross the stream in three places. The lower it gets the more the glen broadens out, and on both sides at the foot of the dark bare schistose cliffs are stretches of soft, level earth, with occasional patches of grass. At intervals small side-glens debouch upon either hand; it was in the outlet of one of the larger of these that we pitched Camp LXXII (alt. 3992 m.). Here we had to the north the termination of the valley of Toghri-saj and at its upper end the Ilve-tschimen, culminating in three conspicuous snow-capped peaks, with red rounded heights below them.

All day green schists predominated, as in the narrowest part of the valley, the dip being  $28^{\circ}$  S.; and the detritus in the bottom of the valley consisted of the same material.

October 13th. In its lowest part the valley of Toghri-saj is fairly broad, the breadth being uniform; but finally it widens out trumpet-fashion and merges into the flat, open expanse of the Tschimen valley. By this the stream had shrunk considerably and it still continued to shrink as it approached the end of the valley. At one spot, where it creeps past a small granite buttress on the right side of the valley, it had contracted to a couple of small frozen rivulets. Hence to get down thus far and join the main stream of the Tschimen valley, which has its origin on the flat saddle of Kosuk-kakti and no doubt picks up a good many tributaries on its way down, was as much as the Toghri-saj rivulet was able to accomplish.

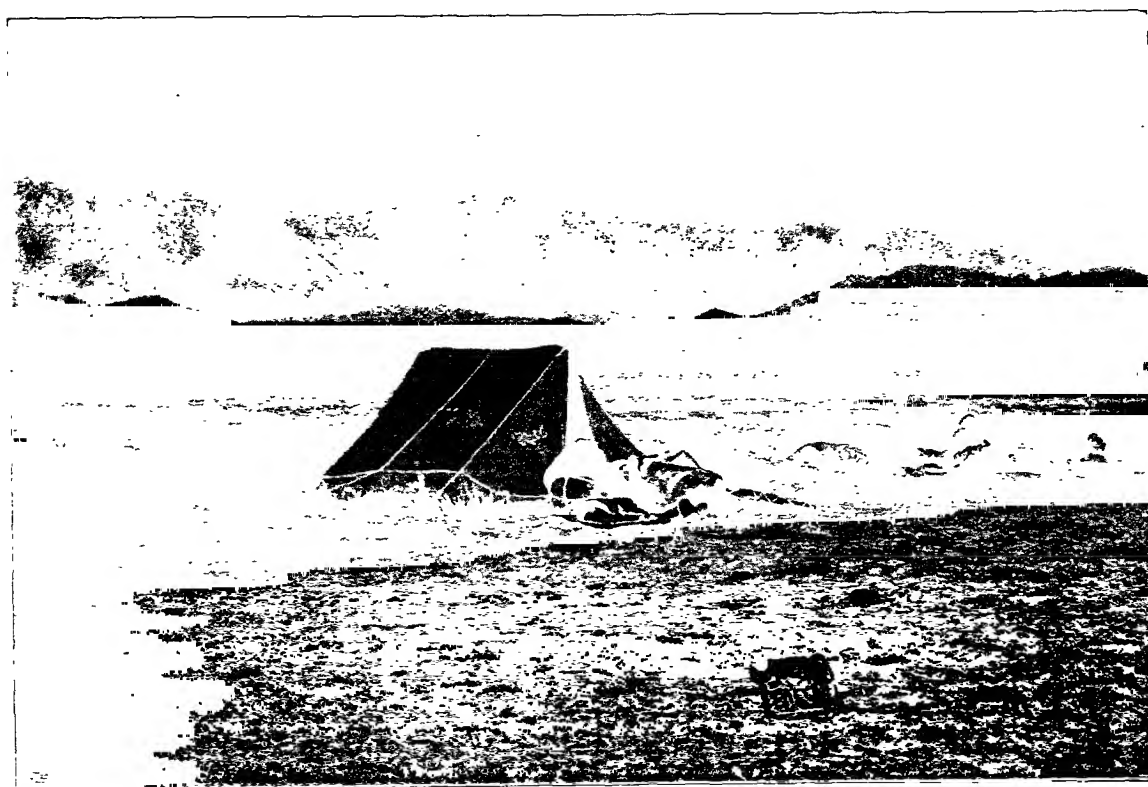


Fig. 159. ILVE-TSCHIMEN FROM CAMP LXXIII (CONTINUATION ON THE RIGHT OF FIG. 158).

Upon emerging from the valley of Toghri-saj, we had to the west-south-west an extensive view across the large Kakir valley (Tschimen), the horizon in the far off distance appearing to be as level as the sea. From that point of view the mountains on the south were very much more imposing than those on the north owing to their numerous large snowy peaks. We now marched straight ahead towards the north-east, brushing against one successive rocky promontory after another. These were the extreme northerly outliers of the Piaslik-tagh, a range that is not of especially great magnitude and does not possess a single snowy summit. Its offshoots and spurs are however fairly massive and craggy, and between them appear small glen-openings, with faintly outlined watercourses, some of which, to judge from their shallow, rounded forms, never, or at any rate extremely seldom, would appear to

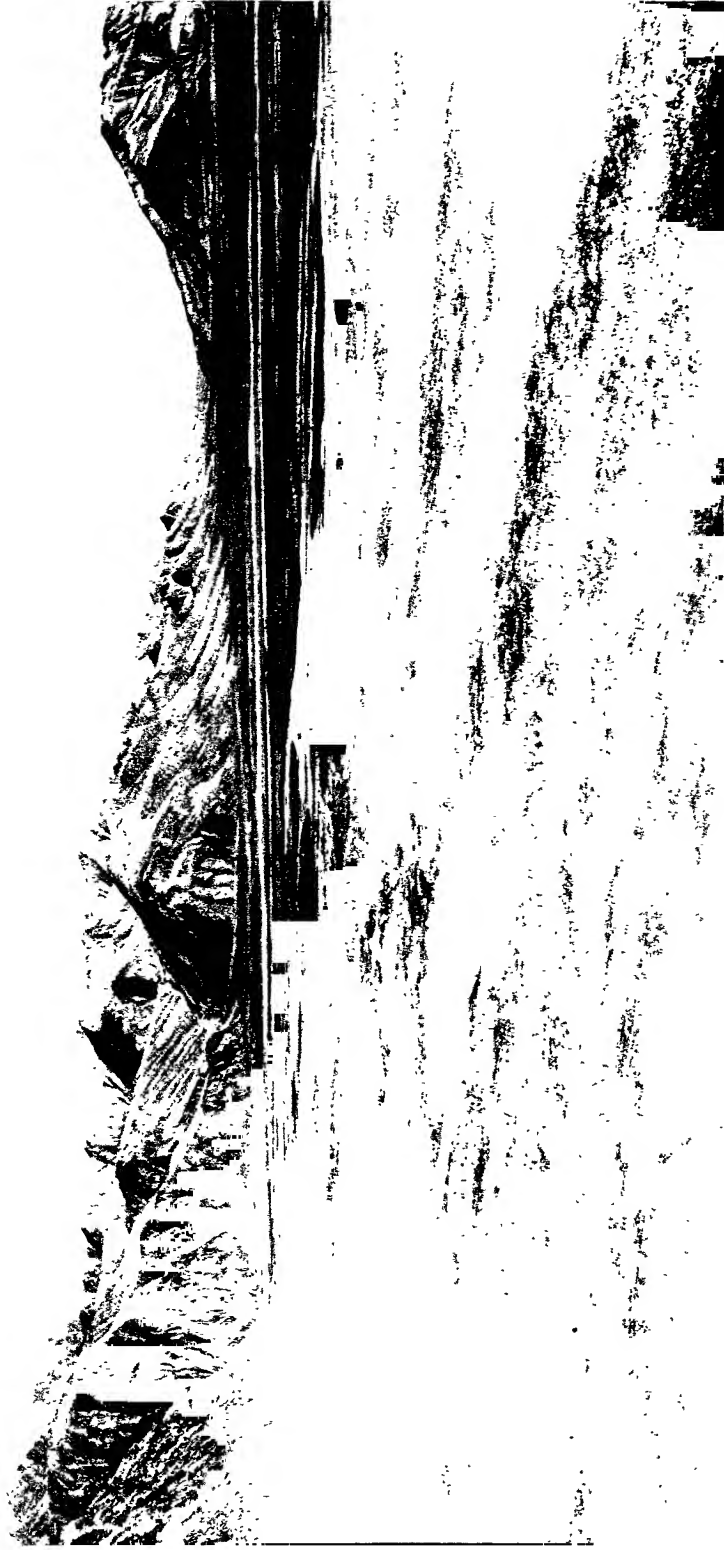
have running water in them. The ground was hard, and strewn with gravel and coarse sand, amongst which a scattering of japkak scrub was growing. Kulans and orongo antelopes were numerous.

To the north, on the westward continuation of the Akato-tagh, rise the peaks  $L_3$ ,  $M_3$ ,  $N_3$ , and  $O_3$ , belonging to the massive chain of the Ilve-tschimen. The peaks themselves were for the most part enveloped in clouds, but the snow-fields on their southern flanks gleamed out very conspicuously. The red heights below them exhibited a very complicated relief, being gashed in every direction by a host of ravines and deep rain-water channels, similar to what we shall find lower down in the east of the Akato-tagh.



Fig. 160. THE EASTERN CONTINUATION OF ILVE-TSCHIMEN FROM CAMP LXXIII (CONTINUATION TO THE RIGHT OF FIG. 159).

We approached the right bank of the stream at an acute angle. The stream was still of a respectable size, with strips of ice under both banks, which consist of high vertical erosion terraces of sand and detritus of gravel-and-shingle. That on the left is especially accentuated. With regard to the stream, it forms an exception to the general rule that obtains in these east-west latitudinal valleys. Generally the stream runs nearer to the foot of the range on the north, as it does more particularly in the latitudinal valleys between the parallel ranges of the Arka-tagh, and as the stream does that flows down the eastern valley of Tschimen to the Ghas-nur. Here on the contrary, at Ghischa and Kisil-bojan, the deeply trenched bed of the



*Ljustr. A. R. Ljustr. S. Westphal.*

SOUTHERN SIDE OF PIASLIK MOUNTAINS, AS SEEN FROM CAMP LXXI.



stream keeps close to the northern offshoots of the Piaslik-tagh. These form small bosses, amongst which we rode in and out.

At Ghischa we found, close to the right bank, pretty good tall grass, although it was then dry and yellow. The altitude was 3769 m.

The little butte on the right side of the outlet of the valley of Toghri-saj was composed of grey granite, lying at  $83^{\circ}$  S., with a dyke of dark-green diabase in it. Below the red hills and slopes which have given rise to the name Kisil-bojan, or the Red Promontory, the detritus and loose fragments of stone consisted of red granite and pegmatite, and the hard rock above pretty certainly consisted of the same varieties of rock. At our camp there was a black crystalline rock, dipping  $84^{\circ}$  towards the S.  $30^{\circ}$  E. Thus while green schist predominated in the valley of Toghri-saj, here the rock was granite.

October 14th. Beyond Ghischa we travelled for a time beside the stream; then, leaving this to the south, we crossed over a more open, flat slope reaching down towards the south-east. The stream

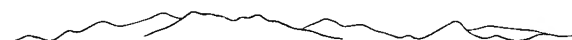


Fig. 161. THE SUMMITS  $L_3$ ,  $M_3$ ,  $N_3$ ,  $O_3$ ,  $P_3$  AND  $R_3$  FROM CAMP LXXIV.

had then a volume of about 5 cub. m., the water being almost limpid, with pieces of ice floating on its surface, while fringes of fixed ice lined the margins. The bottom was filled with debris. Here, strange to say, not only does the stream flow along the foot of the Piaslik-tagh, but it actually cuts its way through several of the north-going offshoots. These form cliffs of a rather wild and picturesque character, their prevailing tones being grey, black, or brown, while between them open out side-glens, sometimes broad, sometimes narrow, though only one or two of these then carried water. On the other hand all of them possessed deeply trenched watercourses, bordered by precipitous terraces often several meters high. After heavy rains these channels will in the summer be able to make important contributions to the main stream, and the latter does indeed bear evidence of carrying at times quite a formidable flood. It should be observed, that the Ilve-tschimen, the loftiest upheaval in the whole region, lies directly opposite on the north side of the valley, and that its gigantic talus forces the river to keep to the southern side of the valley, and even to cut its way through the relatively low-lying offshoots from the Piaslik-tagh. The profile it presents is therefore something like that shown in the annexed cut.



Fig. 162.

After crossing over a fairly flat stretch of country, we once more approached the river at a point where it makes a sharp bend to the left, i. e. the west. The country immediately north of the stream was here rather difficult; for the gently sloping *saj*, which is fairly thickly studded with *japkak* scrub, and strewn with

moderate sized fragments of granite, is further cut up by a great number of small dry ravines, which converge fan-like from every direction upon the sharp bend in the river. These ravines lie close together and are bordered by perpendicular erosion terraces. A long time appeared to have elapsed since they carried water, although one would suppose that the melting of the snows on the Ilve-tschimen would, at any rate in the summer, suffice to feed them. At this point the river was again visible for a short distance through a gap in the hills on its left bank.



Fig. 163. THE SAME SECTION OF THE BEND.



Fig. 164. THE SAME WHERE THE BED OPENS OUT.



Fig. 165. SWELLING OF THE BOTTOM OF THE VALLEY.

Once more we bore away from the river, it being hidden behind the low portions of hills cut off on its left bank. On that same side of it the great talus slopes gently up towards the foot of the Akato-tagh. Upon reaching a low saddle or pass we found a cairn of stones erected, showing that a road really does exist there, though it is seldom traceable, and is principally used by gold-miners on their way up from Tschertschen to Bokalik, as also by hunters. The top of this saddle afforded another extensive view of the river, and its regularly marked bed, the bottom strewn with gravel. By this the detached portions of the offshoots which it had formerly cut off on its left side were come to an end; but on the opposite or right side the cliffs frequently plunged vertically downwards as picturesque naked walls of rock. From the north come several large dry ravines, which have cut their way down through the soft gravel-and-shingle of the great talus slope. The banks of the river consist generally of sand and gravel of a bright grey colour, though in places they are edged with strips of grass. The bottom of the broad bed is formed of the same materials, though it was then only to a very small extent covered with water, which was sometimes collected into a single current, sometimes split up into several branches, as it wound on towards the east.

After following the left bank of the stream for a while, though at some distance, we lost sight of it entirely, travelling away from it at an acute angle. At first we ascended a flattened rise, which, strange to say, was not furrowed by a single ravine, though striped occasionally with yellow bands of clay, left by chance

rains that did not possess sufficient power to scoop out proper channels for themselves. After that the ground was level and hard, excellent to ride on. Gradually we approached the middle of the valley, and eventually we were nearer to the Akato-tagh than to the Piaslik-tagh. Both east and west the country was open to an endless distance. Every now and again we crossed over belts of scrub, in which the japkak bushes were fairly thick. Then we crossed two successive belts with balghun bushes. Camp LXXIV was formed at Jusup-bulak, also called Supa-bulak or Jusup-alik, where several freshwater springs gush out, the grass being relatively tall and luxuriant. Here the altitude was only 3475 m.



Fig. 166. MY INSTRUMENT BOXES.

The small offshoots at Camp LXXIII consisted of granite and mica-schist in alternate strata (fig. 167), and with a distinct bedding of  $66^{\circ}$  S. and afterwards of  $56^{\circ}$  to the S.  $55^{\circ}$  E. The last of the promontories that we passed consisted of granite. After that we observed no hard rock. At Camp LXXIV the character of the mountain scenery had entirely changed. The peaks of the Ilve-tschimen were seen in such foreshortened perspective that it was scarcely possible to identify them, while on the south rose a rather imposing mass of the Piaslik-tagh, with snowy rounded summits. From Ilve-tschimen the Akato-tagh grows lower and lower towards the east, but the Piaslik-tagh rises in the same direction until it fuses with the immense snowy crest of the Tschimen-tagh.

October 18th. Our route now ran almost due east up the middle of the valley of Tschimen. In this part both the bordering ranges are fairly equal in height and neither possesses any outstanding snowy peaks. We did indeed see snow in two or three places, but it had fallen recently. At length we bore to the south-east in order to get round a marsh formed by spring-fed streams; one or two of these we then crossed over, one being rather full of water, which issued out of the ground in a belt thickly set with balghun bushes. In this small well-watered



tract the grazing was very good. On the other side of it we once more found ourselves on hard, almost barren saj, with sand and gravel. But all day we had in sight, at a greater or less distance, the belt of vegetation watered by the stream that originates in the springs. It was astonishing to find that the broad river-bottom which we had marched through the day before had now totally disappeared; but the natives explained that, from the point where we left it on our right, it grows smaller and smaller, until finally it becomes quite lost in gravel-beds in the Tschimen valley. At Jusup-alik however the water reappears in the form of springs, which in their turn go to feed the river afresh. Strictly speaking, it is identically the same river, for the ground continues to slope all the time towards the east; its middle portion flows for a time underground.

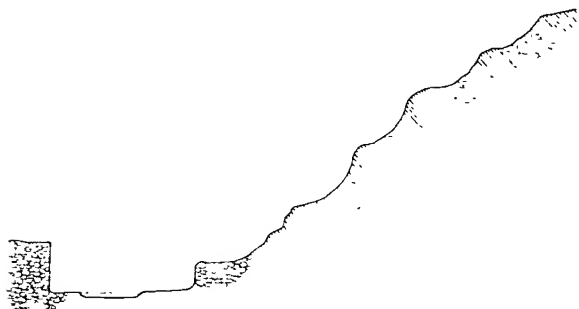


Fig. 167.

At Ghaslik we again struck the belt of vegetation, and found there a small elongated freshwater lake, created by springs. From its lower end issues a rivulet, which will certainly unite with the main stream of the valley. Then we once more had a belt of steppe scrub, growing amongst low, soft sand. The ground now began to rise somewhat, over a hilly swelling, the flat continuation of a northern offshoot from the southern

mountains. On the whole however the valley slopes gradually towards the east, and at some distance to the north, at the base of the swelling, we saw the river of Jusup-alik embraced within its belt of vegetation. The top of the swelling is crowned by several rows of regular and beautifully formed dunes, some of them fused together, others quite separate. They indicate that the prevailing wind blows from the west — this day too it blew hard from the west — for they run transversely across the valley and turn their steep leeward sides towards the east. None of them seemed to be 20 m. high. Thus for a considerable distance along the foot of the eastern Piaslik-tagh and the western part of the Tschimen-tagh there runs a narrow belt of sand, more or less discontinuous. This we were to cross over once more a couple of days farther east. We also found sand at the foot of the eastern Tschimen-tagh, when we passed up the transverse glen of Mandarlik, although the quantity was far smaller, the dunes being rather rudimentary.

From the swelling which I have mentioned dry ravines run divergently down the main valley. Through a breach in the Piaslik-tagh we saw to the south that part of the Kalta-alaghan which on the Russian maps is generally called Amban-aschkandavan.

During the whole of the day a small mountain butte was visible due east, rising in the middle of the broad valley. The river hugs closely its southern foot, and here, on the right bank of the stream, we pitched Camp LXXV (alt. 3378 m.) quite close to the south-west foot of the little butte. Here too we found some small pools, good grazing, and teresken bushes.

October 19th. For two-thirds of our march this day we had the little mountain immediately on our left hand. It is called Kara-tschoka, or the Little Black

Mountain. Its flanks are bare, barren, and desolate, and on the southern flank a rather large quantity of sand has accumulated, sometimes in dunes of some magnitude. Here short transverse glens open out on the south; in one of the last of these, broader than the others, there was a small lake fed by springs. The river winds all the way close to the foot of the Kara-tschoka; when it clings close to the cliffs it is narrow and deep, and when it recedes from them it becomes broad and shallow, and is filled with sediment. Its volume was probably 2 cub. m. in the second, and it was only frozen over where it spreads out into bays and at the bends. On both banks the grazing was good, and farther on the balghun bushes often formed thick clumps. As we proceeded we crossed over a number of extremely shallow watercourses without vegetation, issuing from the Piaslik-tagh and entering the main stream. These evidently carry water only after rain in the mountains, though, strange to say, none of them form definitive beds, but shift and change their courses from one eroded channel to the other. A larger watercourse makes its appearance however over against the little lake just mentioned; it issues from a larger glen in the southern mountains, then visible to us in the S. 1° E. This glen can hardly be any other than the transverse glen, orographically so important, of At-atghan, leading from the latitudinal valley between the Tschimen-tagh and the Kalta-alaghan, a transverse valley that we shall become better acquainted with on our next excursion. This same glen forms the boundary also between the Tschimen-tagh and the Piaslik-tagh, though orographically these two form one and the same range.

On the right hand we passed a second mountain butte, though a good deal smaller and flatter than Kara-tschoka; moreover it is more than half smothered with sand. Between these two mountains stand, on the level ground, several independent, regularly formed, crescentic dunes, and these we passed immediately on our right. These dunes too turn their steep, concave, leeward sides towards the east, though the west wind, which was then blowing, had produced an abrupt edge on the west side of the dunes near their summit.

Finally we left behind us the eastern projection of the Kara-tschoka, with its black and green schists, just where the river turns to the north-east; this soon became lost to sight, though the dark lines of balghun bushes and other vegetation betrayed the course it took. The river flows towards the little lake of Tschimen-köl, at the foot of the Akato-tagh, but never succeeds in reaching it, for it is lost in the dry saj, its waters no doubt spreading out in several arms over a wide area.

Then followed open, flat, barren saj, seamed by several shallow watercourses. The region to the south is reported to bear the name of Kötäklik, and through it a path leads to Bokalik. Probably this goes by way of the transverse glen I have just mentioned. In the south-east rises a great swelling of the Tschimen-tagh, called Kisil-tschap, pierced by a transverse glen of the same name; some of the peaks were powdered with snow. Just as the Ilve-tschimen forces the river to deviate to the south, so the Kisil-tschap forces it to turn back towards the north, driving it up against a part of the Akato-tagh that is especially flat and low, a part that we had crossed over in the summer. East of that depression the Akato-tagh once more swells up, as we have already found, to a vast dome-shaped ridge, after which it sinks down towards Tsajdam, and finally dies out there.

On the left we passed quite a small detached boss of a red colour, and saw a similar one rising from the level surface in front of us. Immediately south-west of the latter a number of fresh springs burst out of the ground, and conjure forth the little balghun oasis of Bagh-tokaj in the midst of the otherwise barren and desolate saj (alt. 3305 m.). The water from these springs runs together and gives rise to a stream which flows towards the north-east, and disappears in the ground in the vicinity of the boss above mentioned. Hydrographically this stream does not appear to belong to the system of the Jusup-alik, but like it dies away in the saj

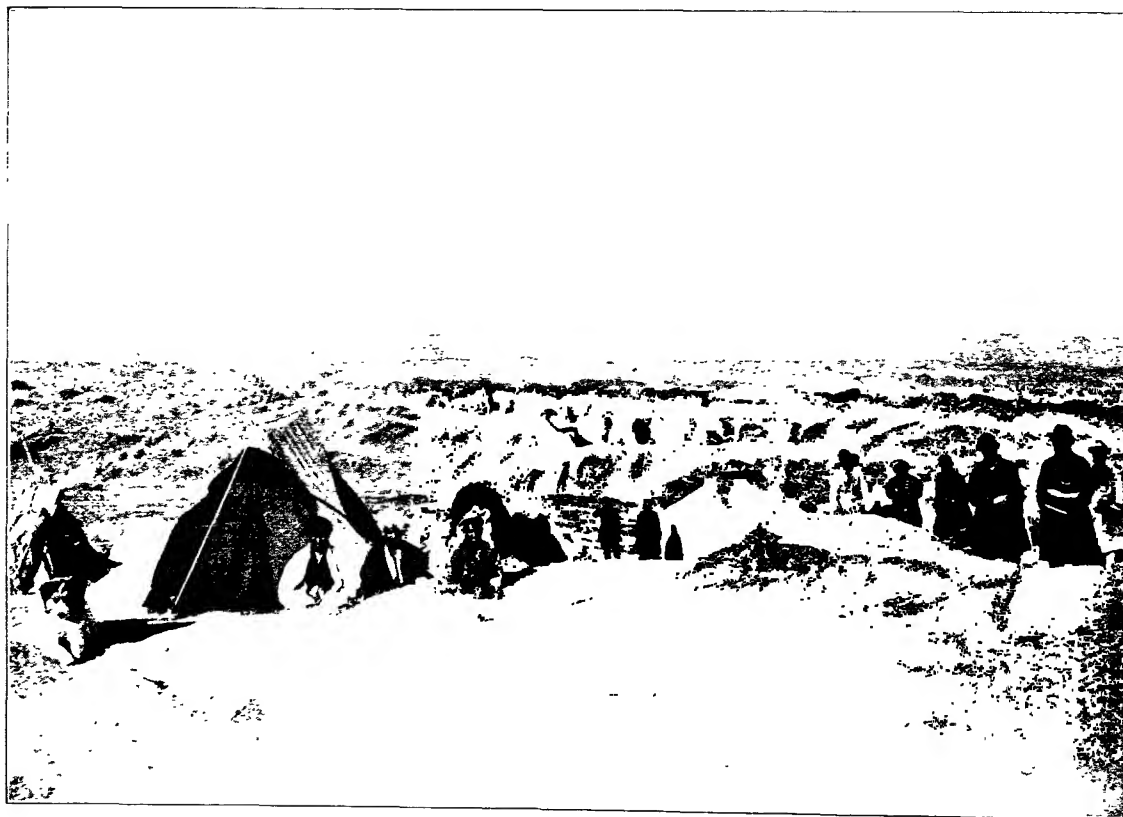


Fig. 168. THE CAMP AT TEMIRLIK.

after inclining more to the east. Thus, although these streams may often carry considerable volumes of water, their effective force is very small, in consequence not only of the aridity of the ground and of the atmosphere, but also of their intermittent character and short duration. We shall find that precisely the same causes are operative in the case of the Tscharklik-su, a stream which, although of considerable magnitude, never succeeds in travelling all the way down to the Kara-buran. As for the springs of Bagh-tokaj, it may be taken as certain that they are fed by the stream that flows down the transverse glen of At-atghan, and disappears into the ground soon after it issues from the glen, but here at Bagh-tokaj once more emerges into daylight.

At one point, in the vicinity of the little lake of Kara-tschoka, the rock was a green schist, dipping  $84^{\circ}$  towards the S.  $45^{\circ}$  E.

October 20th. After we had forded one of the feeders of Bagh-tokaj, a few minutes' ride sufficed to bring us past the belt of vegetation, though we were then accompanied on the left by the stream from the springs. We kept to the north of the second of the little bosses I have alluded to; it consisted of close-grained, greyish-blue rock, dipping  $55^{\circ}$  towards the S.  $40^{\circ}$  W. In consequence of this disposition, the north-east face is the steeper and the more rugged. Just past this feature the stream from the springs became lost amongst its own sheets of ice, though its dry bed continued some distance farther towards the north-east, the bottom being filled with yellow sediment. A couple of kilometers south of our route there now appeared an almost isolated mountain, or group of dark ridges, half buried in yellow drift-sand, and beyond them we saw the belt of dunes stretching on farther to the east. The surface was now hard, barren saj, with gravel and coarse sand, and had a perceptible slope to-



Fig. 169. MY TENT AT TEMIRLIK.

wards the east-north-east. Here we crossed over several shallow watercourses, with very low terraced banks. These are said to owe their origin to *siz-su*, or 'overflow water', which sometimes gets past Bagh-tokaj after copious rains; they are reported to run towards Basch-malghun, although the water will certainly hardly ever reach down as far as that. Another large watercourse which we saw at a distance in the north-west, and which our route did not cross, is reported to go to Sasik-jar. Again the panorama of the Tschimen-tagh was unrolled before us, disclosing fresh glen-openings and fresh mountain-spurs, and its crest here and there tipped with snow. At length the saj came to an end and the vegetation once more made its appearance. After passing Camp VII\* of 10th and 11th July, we continued along the head-stream of Temirlik, which unites some distance farther down with the main stream of the valley. In the loess terraces on its left bank several earth grottoes

\* Camp VII is situated 707 m. S.  $41^{\circ}$  W. from Camp LXXVII.

have been excavated, and their sides and tops smoothed, and themselves provided with narrow doorways. These were formerly inhabited by Mongols. The camp here, LXXVII (alt. 2961 m.) counting from Dunglik, which was Camp I, was one of my principal depots and bases of operations. Here, during the whole period of my absence on this excursion which I have just described, my self-registering barograph and thermograph had been in operation, and here three times every day meteorological observations were taken without intermission. It was from this same camp that I started on each of the two following excursions.

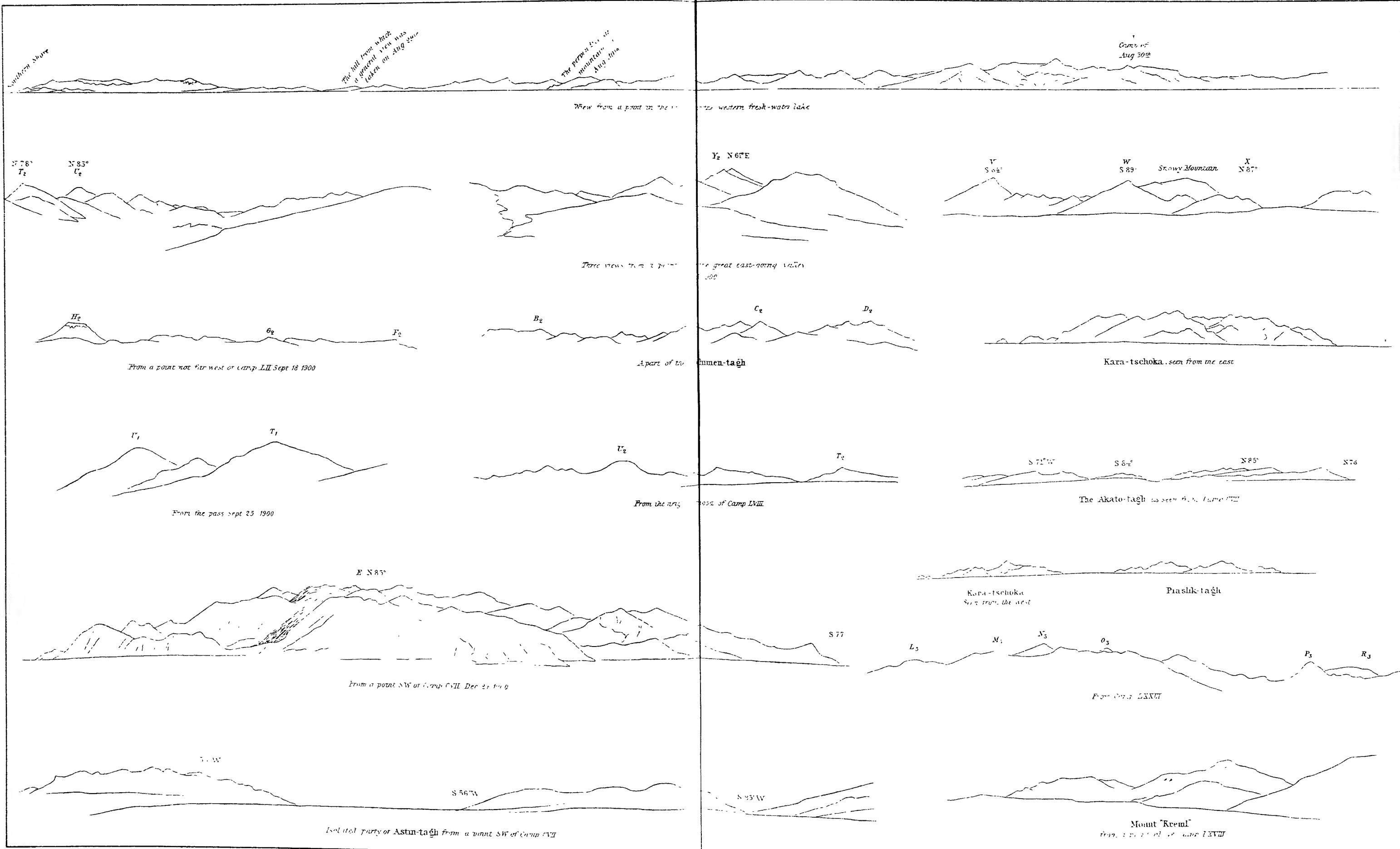
The united head-stream of Temirlik carried on 26th October a volume of only 0.9 cub. m. in the second, the water being as bright as crystal. But its breadth did not amount to more than 0.6 m., its mean depth to 0.3, and its mean velocity to 0.5 m. The springs gush out of the ground immediately above the grottoes of Temirlik, but below them it is joined by several other rivulets from both right and left, e. g. the one beside which Camp VII stood. Most of the water comes from the right and clearly originates in the Tschimen-tagh, although almost the whole of it flows underground and only emerges to the light of day when it reaches Temirlik. In consequence of this distribution of the water the belt of vegetation lies nearer to the Akato-tagh than to the Tschimen-tagh. The feeders from the springs have cut deep channels, and flow about 5 m. below the top of the upper loess terrace and 2 m. below the lower terrace. The latter forms a sort of natural balcony or verandah in front of the entrances to the grottoes, which face south. The region abounds in short, but fairly luxuriant, kamisch. The right bank has a flatter slope, though there too there exists a distinct terrace. It is just below this that the majority of the springs issue. As early as the beginning of November, the water trickling out incessantly had formed on the slope large round sheets of ice, and by the middle of December these had grown to a very great size, and no doubt during the winter they would go on increasing until they formed veritable ice volcanoes, similar to those that I once studied in the glen of Mus-kol in the Pamir.

At Temirlik I investigated the temperature of the ground: at the surface it was  $7.85^{\circ}$ , while the temperature of the air was  $6.55^{\circ}$ . At a depth of 30 cm. it was  $+4.2^{\circ}$ , at 50 cm. it was  $5.33^{\circ}$ ; at 70 cm.  $5.98^{\circ}$ ; at 85 cm.  $6.31^{\circ}$ ; at 100 cm.  $6.68^{\circ}$ , and at 115 cm.  $6.89^{\circ}$ . The ground here was heavily charged with sand and turned moist at a depth of 60 cm., and after that the moisture continued to increase. At a depth of 1 m. we came into wet plastic blue clay. The ground was permeated in every direction by the roots of kamisch.

A large caravan of Mongol pilgrims bound for Lhasa, who had passed Temirlik in the beginning of December on their way to the Holy City *via* Tsajdam, called this region Sum-tun-bulak, or the Three Thousand Springs. Undoubtedly this road from Tscharklik *via* Tasch-davan and Temirlik to Tsajdam, and so on farther, is the usual caravan road to Lhasa; it is at any rate the most convenient for the Turgut (Torgod) Mongols.

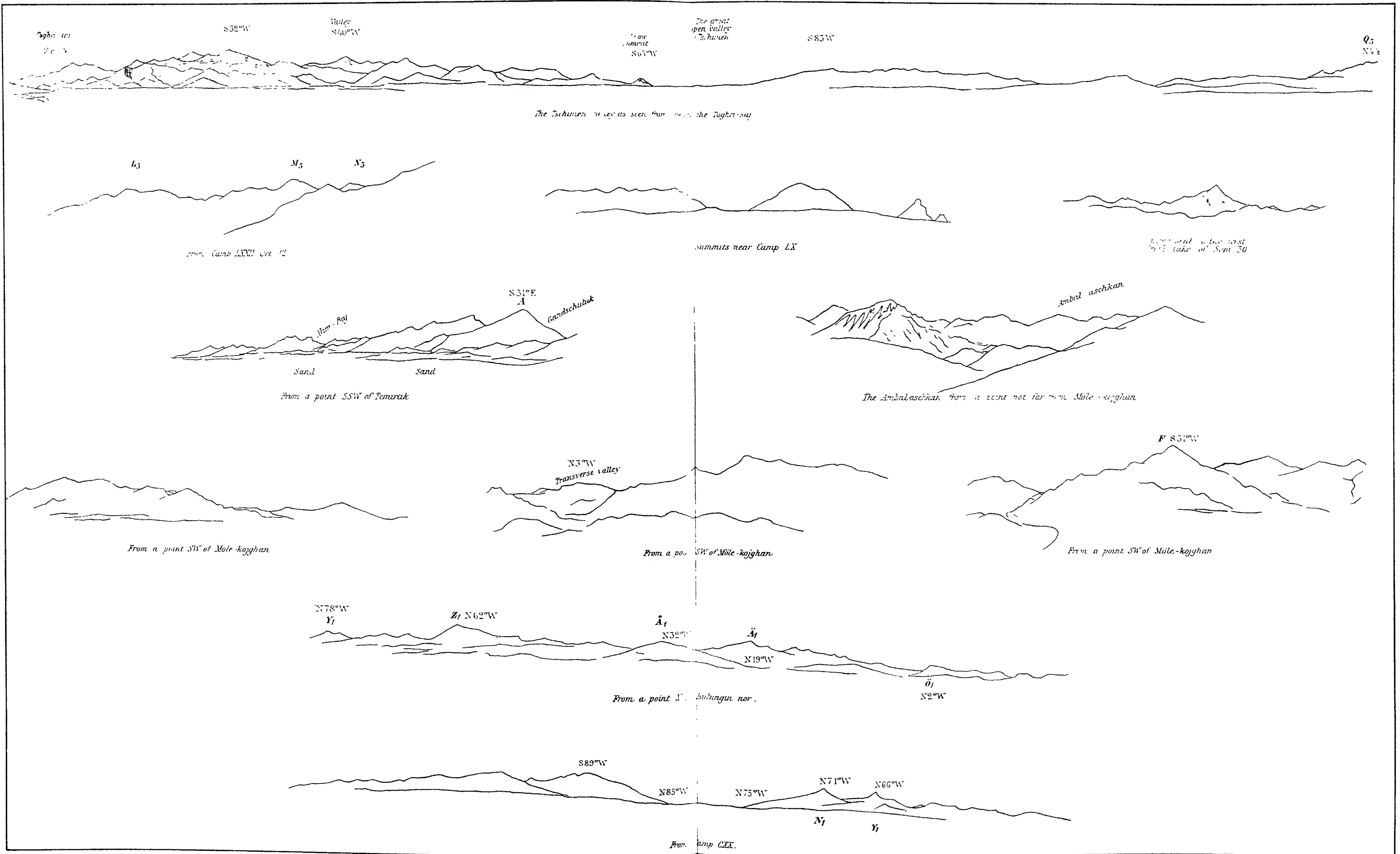
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# EXCURSION TO AJAGH-KUM-KÖL



## CHAPTER XIII.

### OVER THE TSCHIMEN-TAGH AND KALTA-ALAGHAN.

On 11th November I again left Temirlik with a small caravan of horses and mules, with the object of making an excursion to the Lower Kum-köl, crossing on the way several of the parallel ranges of the Kwen-lun system. Upon leaving Camp VII we held to the south-south-west, passing on the right the road to Bagh-tokaj and on the left the road to Kumutluk. To the south we had the Tschimen-tagh — only 23 km. from Temirlik — but eastwards it recedes rather farther from the Kumutluk road. In places the crowning summits of the range were streaked with snow, though none of the great peaks were actually snow-clad.

South of the belt of vegetation at Temirlik stretches a zone of almost level clay sediment (*sägis*), cracked into polygonal shapes, the edges of which were slightly curled up. After that came a thin layer of coarse sand spread over the clay sediment. Except for a few scrubby *schap* plants, the region was absolutely barren. Still farther south grey granite made its appearance in the form of gravel and fragments of stone of moderate size. The belt of drift-sand formed a yellow strip along the foot of the Tschimen-tagh. Immediately west of a rather more prominent boss in the range that lay south-east of us we discerned the glen of Gändschuluk-saj, which, like all its neighbours, runs down to the Ghas-nur. Between this and the glen of Savughluk, which we were aiming for, there is a third, Tschigelik-saj, the entrance to which was likewise visible.

It was not until we advanced pretty close to the mountains that we struck the drift-sand. At first it was low and scattered, and frequently interrupted; but the dunes gradually increased in altitude, and here again, with inflexible presistency, and in regular, sharply accentuated shapes, they turned their steep leeward sides to the east. This made it perfectly plain that, at any rate at that season of the year, the westerly winds are absolutely in a majority, as indeed we found later on that they are in the interior of Tibet during the whole of the winter. The sand continued to increase in height right away to the foot of the mountains, where it reached 10 to 15 m. Yet this dune expanse is neither so compact nor so continuous as that which lies, for example, beside the Kum-köl. For the most part we were able to follow a comfortable track between the dunes, travelling sometimes south, some-

times S.  $25^{\circ}$  W., and only occasionally did we need to cross over outliers or wings jutting out from them. We thus had their steep leeward faces close to us on the right, and on the left their flat windward slopes. The former were deeply in the shade, the latter brilliantly lighted by the sun.

The view from the top of one of these dunes was especially instructive. Before us stretched, flat and desolate, the entire length of the Akato-tagh, with not a scrap of snow upon it. Along its foot was the darker line of the vegetation, nourished by the springs of Temirlik and other places, and even to the unaided eyesight it was quite apparent that we had ascended a pretty good distance since we left them. We could only surmise where Ghas-nur lay to the east-north-east. During the still, warm hours of the day we observed in the west a mirage like those that are common in Tibet, though this one was more sharply outlined than usual. We see not only the lowest slopes of both the Tschimen-tagh and the Akato-tagh, but between them, in the middle of the Tschimen valley, the free-standing mountain of the Tschoka-tagh. In the spaces between there appear to lie the still tranquil waters of a couple of lakes, in which the outlines of the mountains are clearly and distinctly mirrored. By a mere chance these two lakes run together under the Tschoka-tagh, so that this mountain appears to be entirely detached and to be hovering above the horizon. In order that a mirage of this character may be seen, the spectator requires to be at the same level as the landscape that is in this way reflected, for the nearer we approached to the foot of the mountains the fainter grew the mirage, until finally it disappeared altogether. Further conditions are that a warm, still, clear day be followed by a cold night and that the sun shine from the same direction as the landscape mirrored, or at an angle of  $90^{\circ}$  towards it. In this instance we had the sun in the south and the mirage in the west. I have already made mention of a similar phenomenon at the large salt lake at Camp XXXII, but that moved as the sun moved.

Meanwhile we had crossed the belt of sand and reached the entrance to the glen. Descending a couple of steep erosion terraces on the right-hand side of the glen, we then marched up it along its lowest part. Here the glen of Savughluk-saj descends from the south-south-west, but upon emerging turns to the N.  $65^{\circ}$  E. and continues towards the Ghas-nur. Thus its eroded watercourse keeps close to the granite cliffs on the right-hand side of the valley, the cliffs being in part unincumbered and in part marked by gravel-and-shingle and coarse sand, arranged in terraces. The drift-sand reached down to within a couple of hundred meters above Camp LXXVIII, where it covered the lower slopes on the left-hand side of the glen even at its outlet. Thus both here and outside the glen entrance the drift-sand dunes have piled themselves up exclusively on the left bank of the stream, as indeed one would expect from the configuration of the ground and the fact that the prevailing winds come from the west. The right bank is on the other hand entirely free from sand; in fact there is not much room for dunes to accumulate in.

Narrow though this belt of sand is which we have thus encountered between Ghaslik and Mandarlik, yet in its orientation it reminds us so very forcibly of at least two other sandy localities in the same region, that I feel justified in laying down the following law of geographical homology. In a broad long-axial valley,



CAMP LXXVIII IN SAVUGHLUK-SAJ.



*Exposit. A. b. Lagrange & Westphal.*

A WOUNDED ORGNGO ANTELOPE.





which stretches from east to west between two parallel mountain-ranges and is itself highest on the south, the sand-dunes — supposing indeed that there are such — tend to occur at the northern foot of the southern range, that is in the highest part of the said valley. We have already encountered the same thing, though on a much greater scale, in that part of the Desert of Gobi which stretches between the Kuruktagh and the Astin-tagh, where the belt of dunes extends along the northern foot of the last-named range, or more correctly speaking along the northern base of its foothills. And we have seen the same grouping repeated beside the Upper Kum-köl, the drift-sand there scrupulously avoiding the lowest part of the broad valley on the north. In the Desert of Gobi we found that the north-east and east-north-east winds have swept the sand together towards the foot of the southern mountain-range. Here in northern Tibet, where westerly winds prevail, it is more difficult to account for the grouping being the same. Possibly it is the north-east winds, or rather perhaps the north-west winds, which here drive the sand towards the south, for at the most all that the westerly winds can do is to move the dunes along the base of the southern mountain-range and parallel to it.

At Camp LXXVIII the right terraced bank rose 3 m. above the watercourse at the bottom, in which was a tiny rivulet covered with ice. From this spot Kisil-tschap, our next day's goal, can be reached by a lower road, which runs westwards, having the foot of the mountains on the left and the belt of sand on the right, passes the spring of Kum-bulak, and so enters the glen of Kisil-tschap. I heard the name of the glen in which we encamped pronounced in two different ways — Savughluk (from *savugh* = »earth-cave» or »grotto») and Soughluk (= »the cold region»). The rock at the entrance of the glen consisted of a pink coarse-grained granite, while pieces of fine-grained granite, of a light grey and dark grey colour, and up to 1 cub. foot in size, lay scattered outside the glen mouth, forming stripes pointing to the north-north-east. In the glen-mouth the altitude was 3,444 m., showing a very noticeable rise as compared with Temirlik.

November 12th. The glen led us practically due south, the windings being insignificant; the ascent, though not steep, was pretty uniform, and distinctly perceptible. The sand came to an end all at once just above the camp, for the lower slopes are there protected by massive buttresses of the mountain. In two or three places the dunes reach all the way down to the edge of the watercourse, and even in part rested upon the ice, a proof that a fresh sand-slide had taken place during the last westerly gales, since the ice formed. From this we may also infer, that the brook acts as an impediment to prevent the dunes from rising above a certain maximal altitude; for the increase which takes place during the winter, and of which the slight advance of the base of the dunes out upon the ice is the expression, is neutralised in the following spring and summer, when the flood that rushes down the brook sweeps the sand out to the lowlands, and the dunes are again diminished in height.

Just above the point where the sand comes to an end, the glen of Savughluk contracts to a veritable gorge, its stream having cut its way down through the perpendicular granite cliffs, while the breadth is often not more than a couple of meters, indeed sometimes only one meter. Here the path makes a slight detour, climbing up over a rounded col on the left-hand side of the glen, with steep acclivities

on both sides. Below this col is a small open space, and here are situated the springs that feed the brook. Above that point the glen is absolutely waterless; though the energetic way in which it has been eroded proves that sometimes it must be traversed by a very effective volume of water.

At the next expansion of the glen, where we turned to the south-south-west, a side-glen comes down from the east, being bordered on the south by rather imposing cliffs. This side-glen leads up, I was told, to a smaller pass, over on the east side of which lies the glen of Tschigelik-saj. After climbing up a considerable distance towards the south, we reached a large cauldron-shaped expansion or gathering-basin, upon which several minor glens converge in order to form the Savughluk-saj. Here our passage southward was barred by a mountain of especially massive proportions; this compelled us to deviate to the south-west. The hunter's track we were following then led up, over rather steep hills, flanked on both sides by deep watercourses, to a comfortable pass (alt. 4,106 m.); it is of a secondary character and is situated in a spur of the main range of the Tschimen-tagh. In descending on the west side we kept to the left terraced bank of the brook that goes down the glen — soft hills with a thin sprinkling of grass on them, and often scored across by deep ravines from the side-glens on the left. This new glen is framed in between wild, rugged, denticulated granite crests of striking magnitude. The springs of Kisil-tschat are situated in an expansion (alt. 3,890 m.) of the glen, and below them the crags on either side form a veritable gateway of noble dimensions. Beyond it the glen widens out again, and in the vicinity of Kum-bulak debouches upon the Tschimen valley. Thus we had on the north and north-west of our route a relatively independent portion of the Tschimen-tagh, its only connection with the main chain being the flat ridge which we crossed over by the pass I have last mentioned.

In these mountainous regions there was but a slight quantity of snow. We had found the Tschimen valley completely free from it, except for one or two thin patches in sheltered positions on the north side of the dunes. Above Camp LXXVIII about one-fourth of the area was covered with snow, and snow clung in the crevices facing north, whereas the slopes facing south were entirely free from it. On the east side of the pass the snow formed a thin and almost uninterrupted sheet; on the west side it was very thin, and as we approached Kisil-tschat it ceased entirely, the reason of this being no doubt that this glen is too much exposed to the fierce westerly gales.

All day we marched amongst crystalline rocks, especially divers varieties of granite, differing in both texture and colour. At the camp there was a light-coloured granite of medium-sized grain, and it was followed by a light flesh-red granite and a fine-grained light grey granite of rather a striped appearance — this was north of the glen leading up to the pass of Tschigelik. South of this we observed a dark-grey, fine-grained granite and then a species of heavy, compact, black rock, probably diabase. At the pass an almost white fine-grained granite alternated with diabase, and in the glen leading down to Kisil-tschat there was a black schist dipping  $51^{\circ}$  E. The gravel and fragments of rock that litter the bottoms of the glens consist of rounded polished granite. Hard, naked rock is general everywhere; but in the cauldron-shaped valley and the immediate neighbourhood of

the pass the surface is for the most covered with soil, with a sprinkling of vegetation.

November 13th. Our route now led towards the west-south-west across gently rounded slopes, the first of which are connected with the abruptly terminated cliffs on the left side of Kisil-tschap. From this latter we enjoyed a magnificent view of the great spur on the right side of the glen: it is singularly steep and its cliffs often form sheer precipices. Nevertheless the spur soon decreases in height and eventually terminates in the region of Kum-bulak. To the north-west of it lies the little flat boss, half buried under sand, which we perceived from Bagh-tokaj. The slopes which I have mentioned are those of an imposing crest, and their watercourses, littered with gravel and larger fragments of granite, gradually converge upon Kisil-tschap.

After crossing over the highest of these numerous rounded stretches, we turned off to the south-west, in order to ascend a minor transverse glen on the northern flank of the Tschimen-tagh. This glen is joined by a side-glen coming down from the east-south-east and running parallel to Kisil-tschap, so that it consequently has a more east-west direction. It is however more correct to look upon this as being the beginning of the main glen. Its name is Kisil-tschapne-könäsi, or the Southern Kisil-tschap, and at its head rises a huge swelling of the Tschimen-tagh, a swelling that must be identical with the mountain-mass which had barred our way the day before. The orographical arrangement here appears to be such that the Tschimen-tagh sends out a vast spur towards the north, and from it again branches project, certainly they do towards the west and probably also towards the east, and thus lie parallel with the main range. It would however be improper to speak of several parallel ranges of the Tschimen-tagh in this locality, for, as we shall presently see, the entire system can be comfortably crossed over by a single pass. The whole of this swelling is thus an excentric outgrowth on the northern side of the Tschimen-tagh. As in the region of Mandarlik, so here, we find that the ruggedest and grandest parts of the Tschimen-tagh are situated on the north of the crest that contains the actual pass.

There are said to be hunter's paths in the glen I am speaking of, and one of these at its extreme upper end leads by an easy pass over the main range of the Tschimen-tagh, and so down into the great latitudinal valley on its southern side. Another of these tracks leads northwards over the crest that we recently had on our left hand, and so descends into Kisil-tschap. The southern declivity from this pass is easy and flat, while the acclivity on the north is steep and difficult.

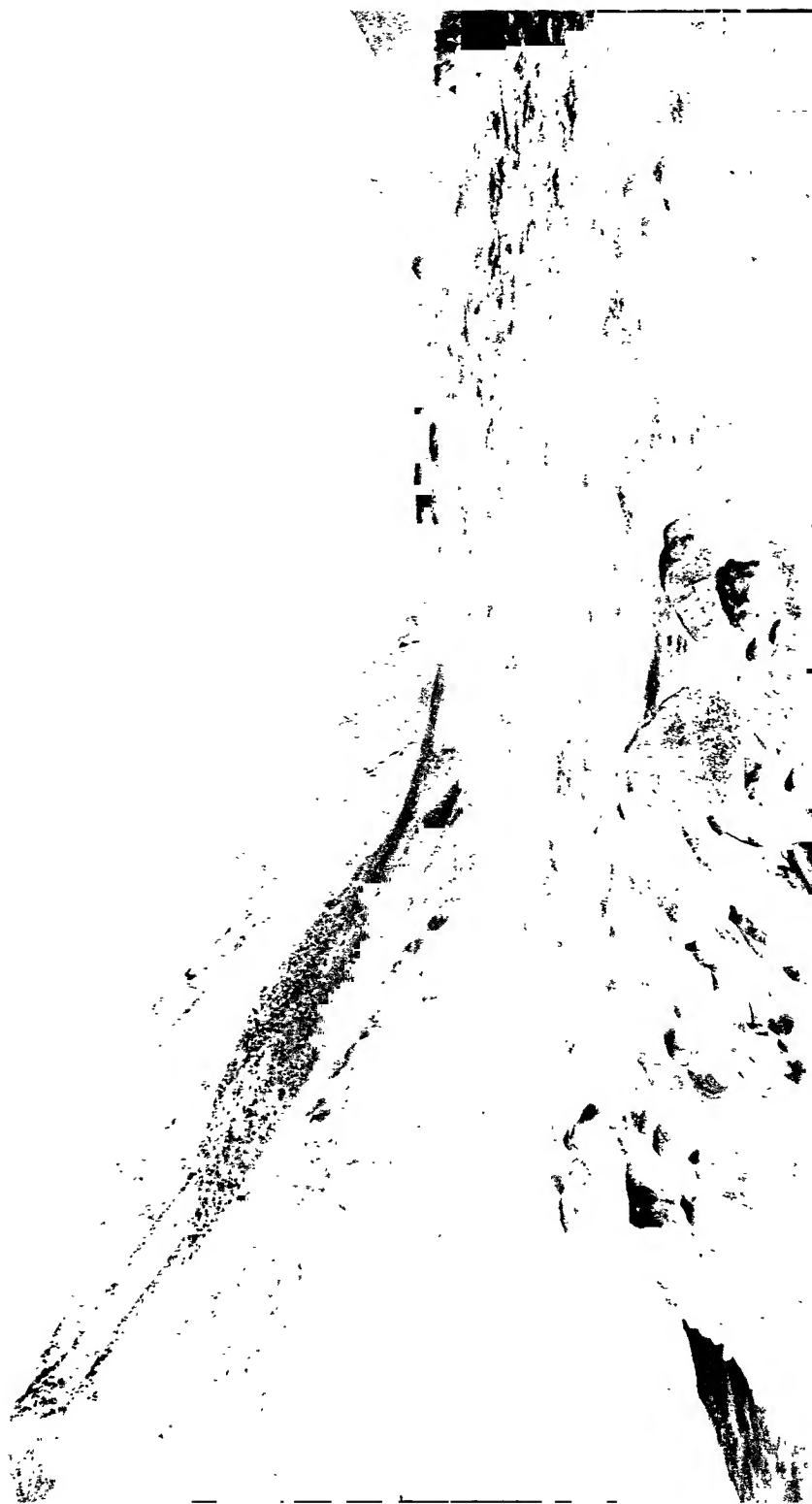
The northern slope of the Tschimen-tagh, which we now proceeded to cross towards the south, is especially broken and cut up by a host of rainwater channels running down to the principal glen, which, like the Kisil-tschap, makes its way to the great Tschimen valley in the neighbourhood of Bagh-tokaj. Possibly the two glens unite before that, though after they emerge from the mountains. We ascended to the pass over ground that was throughout covered with soft soil; the pass is flat and easy, and has an altitude of 4034 m. It seems to be characteristic of the Tschimen-tagh, that its main crest containing the pass is composed of soft materials, that it is of rounded outlines, and is situated south of its highest rocky parts. From the pass of Kisil-tschap a very distinct and energetically excavated transverse glen

leads down, first due south, then south-west, but the descent is very gentle and easy. The tolerably short granite spurs that jut out from the southern side of the range are massive and imposing, but terminate in rounded slopes, covered with soil and a thin sprinkling of grass. In some places however the hard rock reaches down to the bottom of the glen, the stream in which was then dried up, and there were beside it, especially on the right, long reaches of more or less thick gravel-and-shingle terraces. A good track, though rather stony, runs now along the right terrace, now along the left. The only wild animals we saw were hares; though the droppings of wild yaks were pretty common, as indeed they are throughout the whole of the Tschimen-tagh region.

Upon reaching the end of the glen the dry torrent turns towards the south, and the spur on the left side of the glen is continued by smaller protuberances and hills. The detritus scree has a flat fall from the end of the glen to the stream that runs down the latitudinal valley with its belt of vegetation.

All day we travelled through granite, mostly of moderate-sized grain and with a touch of green in it. All the *débris* in the watercourses and gravel-and-shingle terraces likewise consisted of granite. Thus we had once more crossed over the Tschimen-tagh and ascertained that its conformation here is far simpler than in the region of Mandarlik. By travelling from Bagh-tokaj by way of Kum-bulak and Kisil-tschap the range may without especial difficulty be crossed in a single day, and by only surmounting a single pass. The latitudinal valley possesses an important drainage stream, although it is divided into numerous arms. At this time several of these were frozen over and only in one of them did we find as much as  $1\frac{1}{3}$  cub. m., the water, derived from springs, being bright as crystal. The bottom is plentifully strewn with *débris*. This region is called Möle-kojghan, and has an altitude of 3594 m.

On the 14th November we crossed the latitudinal valley transversely. At its deepest part it is very flat and level, but after the belt of vegetation ceases, it begins to ascend slowly towards the foot of the Kalta-alaghan. The surface here is rather soft, consisting of coarse sand, thinly dotted over with scrub. We passed over a great number of small watercourses running towards the north and entering a larger watercourse that terminates in the chief head-stream of the Möle-kojghan. On the west of them a whole series of small hills reach all the way down to the glen. At the point where we crossed the stream that lies immediately east of the transverse glen of Tus-bulak — this is after it issues from the Kalta-alaghan — its bed is deeply and energetically excavated, and not only has it a double set of erosion terraces, but the bed itself is partly filled with *débris* and small fragments of rock. Between this transverse glen and the transverse glen of Tus-bulak there rises a massive bluff, the slopes of which we crossed over in order to reach the entrance to the latter glen. The eroded watercourse in this glen too is very distinctly excavated, and on its left or west side it is accompanied by steep rocky walls and hills. The spring of Tus-bulak had given rise to the formation of extensive sheets of ice and veritable ice cascades in the bed of the watercourse. In the left side of the glen the brook has hollowed out a grotto in the granite rock. The altitude here is 4043 m.



*Ljush. A. B. Lagrelus & Westphal.*

CAMP LXXXI, VIEW LOOKING DOWN UPON THE LATITUDINAL VALLEY OF MOLE-KOJGHAN.



The spurs on both sides of the glen of Tus-bulak consist of a light green granite of moderate grain.

Let us now take a brief survey of what we have hitherto learned regarding this latitudinal valley between the Tschimen-tagh and the Kalta-alaghan. Viewed from Camp LXXX at Möle-kojghan, its upper part appears to stretch to the S.  $80^{\circ}$  E., while its stream descends towards the N.  $75^{\circ}$  W., to the breach through the Tschimen-tagh, a very distinct portal, upon which the streams converge from both east and west, as into a funnel, and through it they make their way northwards to the Tschimen valley, entering it directly opposite to the eastern end of the

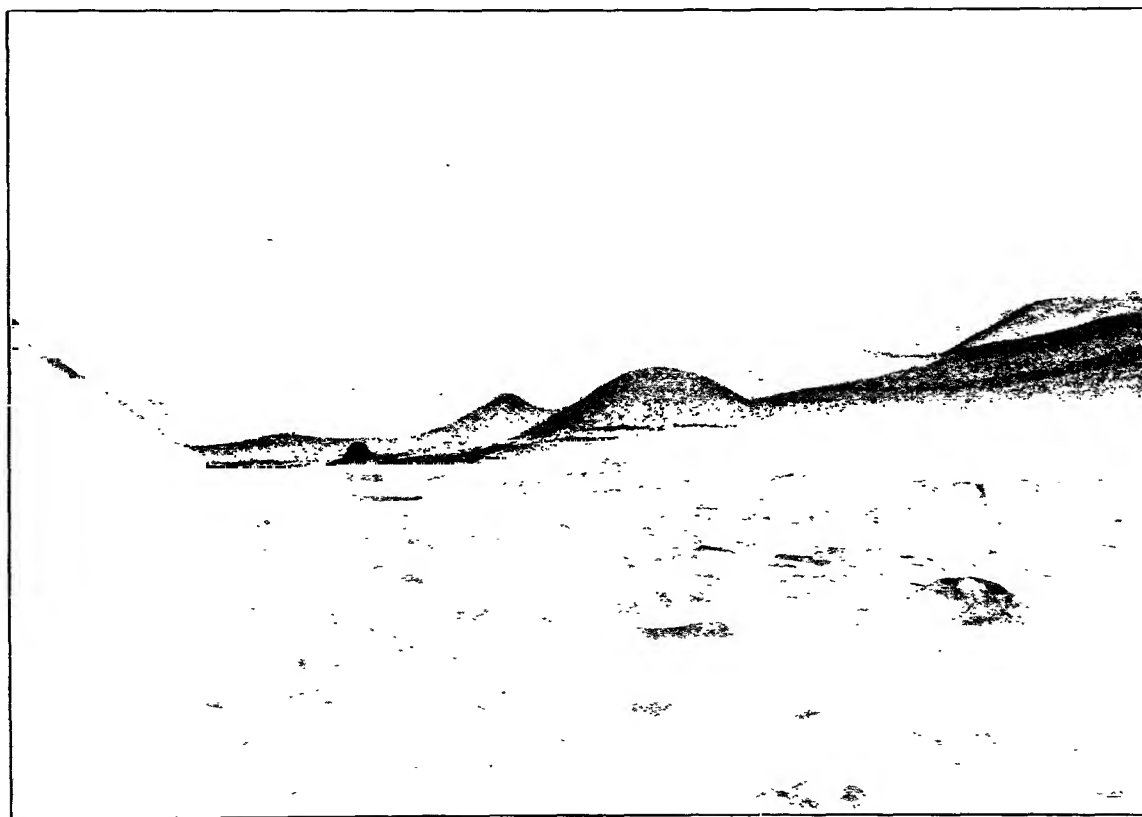


Fig. 170. CAMP LXXXI (TUS-BULAK) LOOKING DOWN TOWARDS MÖLE-KOJGHAN.

Kara-tschoka. From that point we had also been able to observe the portal of the breach on its northern side. From Möle-kojghan we saw to the N.  $88^{\circ}$  E. a massive snow-clad protuberance of the Tschimen-tagh. In the S.  $80^{\circ}$  W., but at a considerable distance, rose yet another snowy mass, belonging to the Kalta-alaghan and situated in the region of Murghun-alik. On the nearer side of this last, and not very far west of Möle-kojghan, lies the pass of Amban-aschkan-davan, situated in the Kalta-alaghan, a pass that was used by Carey and Dalgleish as well as by Bonvalot and Prince Henri d'Orléans. On the map of the Russian General Staff that part of Kalta-alaghan which lies west of this pass is called Ambal-aschkan, a name which is not only unnecessary, seeing that it all forms one and the same range, but also quite incorrect. It is only the pass that is called Amban-aschkan, or »Where

the Amban Crossed over», an unmistakable reminiscence of the visit which some Chinese amban once paid to this region. For instance, during my absence the amban of Tscharklik paid a visit to my camp at Temirlik, and from it rode on farther to the gold-mines of Toghri-saj, that he might with his own eyes convince himself of their value.

On the map of the Russian General Staff the valley between the Tschimen-tagh and the Kalta-alaghan is called At-atghan or the Shot Horse, an allusion to the trivial circumstance, that a hunter, after a run of bad luck, was on the point of perishing of hunger and was obliged to kill his horse. The name of Möle-kojghan, or the Saddle Pulled off, is derived from the same episode. The latitudinal valley is of course called quite simply Kakir, like the other similar latitudinal valleys; but it will be as well to retain the name of At-atghan in default of a better. In the tract south of Mandarlik this valley bifurcates on each side of the Ara-tagh, which thrusts itself in between the Tschimen-tagh and the Kalta-alaghan.

From the top of the pass in the Ara-tagh we saw to the south-west another pass leading over the Kalta-alaghan, which however we did not use. The transverse glen that leads down northwards from the latter pass is said to bear the name of Kalta-alaghan-saj. Counting from this glen and proceeding westwards, my guides enumerated the following transverse glens in succession on the northern slopes of the Kalta-alaghan, all of them joining successively the main glen of At-atghan — Kulan-mätschit, Tosluk-saj, Kisil-saj, Iskenderne-saji, Tus-bulak (the glen in which we pitched Camp LXXXI), Amban-aschkan, Ak-tschoka, Kisil-tschap (No. 2), Murghun-alik, Piaslik. All these belong therefore to the same region and reach the transverse glen through the Tschimen-tagh. I was also given the names of the following transverse glens situated farther west and belonging to other hydrographical systems. All these likewise run towards the north; some of them we have already become acquainted with. They are Ligen, Toghri-saj, Kaschalik, Korumluk-saj, Ghal-saj, Unkurluk-saj, Dung-saj, Turdumet-alik, Inek-akkan, Kosuk-kakti (or kakkan), Dimen-alik, Basch-malghun, Tokus-davan, Monur-bulak, and then Kätschik and Tschertschen. Pisat-saj appears to be a transverse glen between Kosuk-kakti and Dimen-alik. As for the transverse glens on the south side of the Tschimen-tagh, I was told that they are known by the same names as the glens that correspond to them on the northern side of the range. Consequently there are two Halim-bajs and two Gändschuluks, and so on, each of these pairs of glens being separated by a pass in the summit of the range.

November 15th. As it approaches the pass the transverse glen of Tus-bulak contracts and grows steeper. The crests on both sides were quite close to us; but on the whole the range produces a less imposing effect than the Tschimen-tagh. Grass grows on the soft, earthy slopes almost all the way up to the pass, but otherwise the surface is very stony, and the bed of the watercourse filled with débris and fragments of rock. But only in two places has the stream eaten its way in close to the granite cliffs on the left side of the glen in the same way as at Tus-bulak (Camp LXXXI); in other places its course lies between steep earthy hills. All the way up, the bottom of the watercourse contained large sheets of ice, but we saw no running water. In the mouths of several of the small side-glens there were also patches of ice, indicating the presence of springs. Here wild yak drop-



pings were very abundant, as in the Tschimen valley, and as we turned in to Tusbulak we saw large herds of both wild yaks and kulans. Hares and marmots were also common.

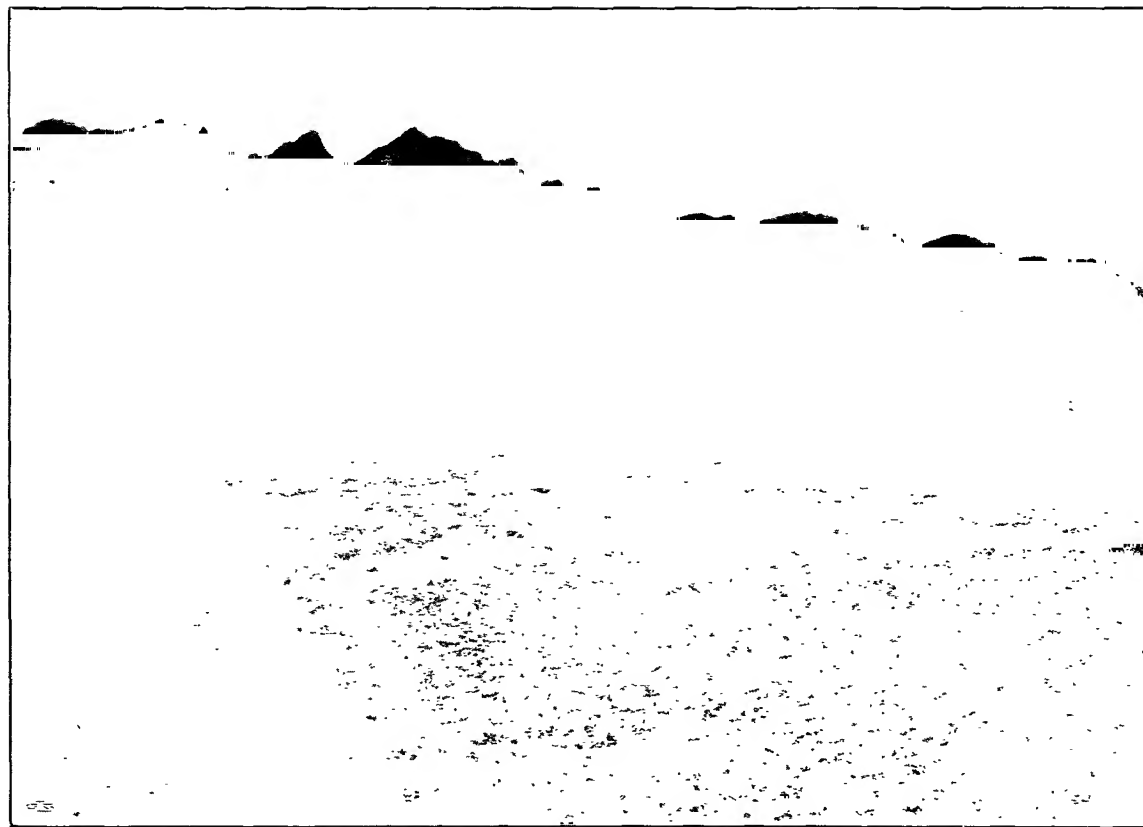


Fig. 171. KALTA-ALAGHAN FROM CAMP LXXXII.

A distinctly marked path leads up to the pass, so that this route must be not infrequently used by hunters and gold-miners, while on the summit of the pass we found a cairn of stones built up. The pass is easy, although its altitude reaches 4438 m. It is overhung by rather formidable cliffs, especially on the west, while on the east it is dominated by a crest of red granite. A couple of hundred meters west of this pass there is a second, somewhat higher, but without name. The name of our pass is quite simply Tusluk-sajning-davani or Tusluk-davan. Snow was found only on the northern acclivity of the pass and in the Tusluk-saj, and then merely in patches, but on the southern side there was none at all; nor had the main water-course in the descending glen either springs or patches of ice. The declivity on the south is much steeper than that on the northern face, the glen being both deeper and narrower, jammed in between short, but immense spurs of red granite, cleft by several small steep side-glens and ravines, none of them long. At the first expansion that it makes our glen is joined by several others, a smaller one from the right, and a large one and various small ones from the left. Farther down it is joined by yet another side-glen, likewise on the left, which comes from the east-south-east, and

consequently describes an arc round a protuberance on the left-hand side of the glen.

After proceeding a short distance south we turned towards the south-west, close to the mouth of the glen, having immediately on our right hand the extreme offshoots of the right side of the glen. These are especially compact and wild, with pinnacles, promontories, and minarets, all of red granite. The extreme outliers of the left side of the glen are less connected, and terminate in several detached pinnacled summits and protuberances. The general impression is one of wildness and fantastic ruggedness, and the bare cliffs reach all the way down to the bottom of the glen, in which there lies an abundance of detritus. We turned away, to the right, from the eroded watercourse; this is very accentuated, being inclosed between steep erosion terraces, often rising in two stories. It evidently owes its energetic excavation to temporary floods of rainwater. But after passing the last outliers on the left, it grows both shallower and broader in proportion as the steepness of its fall towards the south decreases.

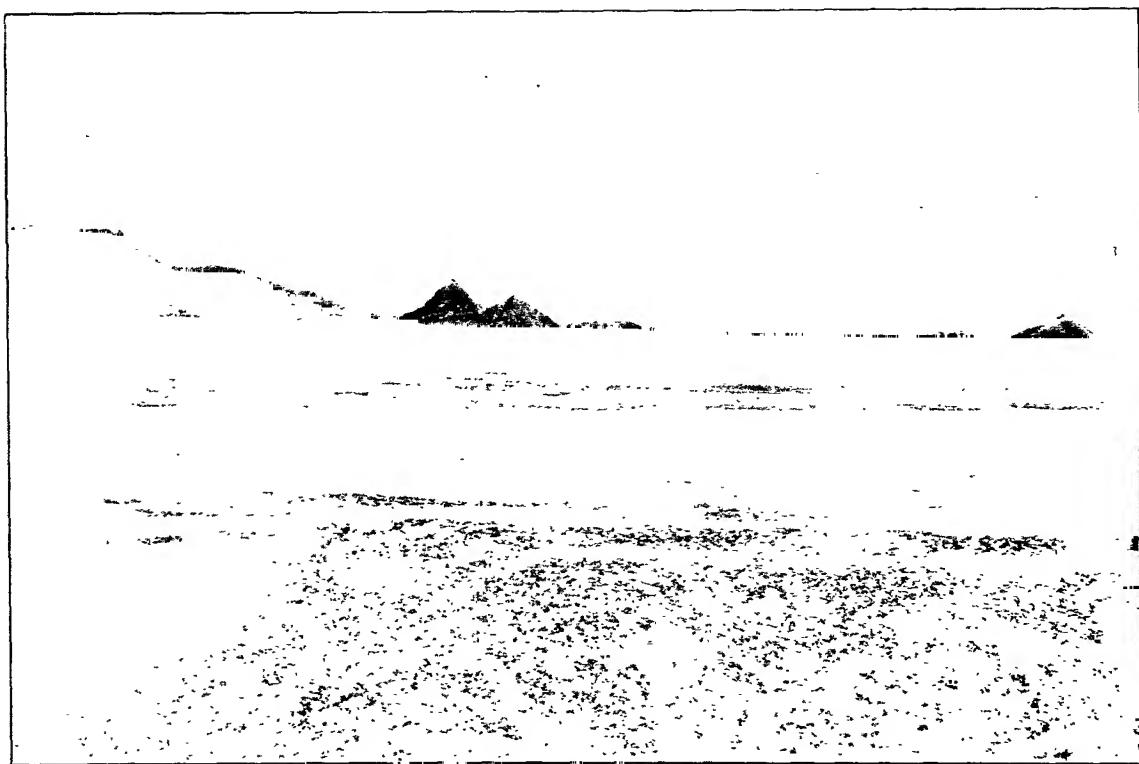
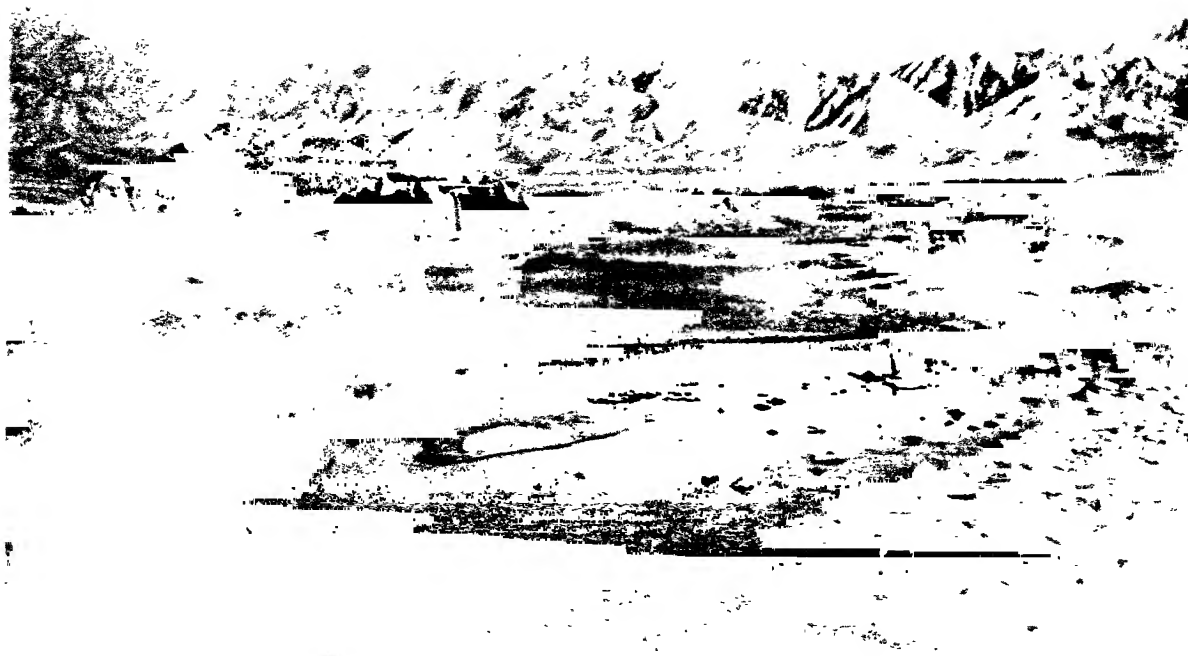


Fig. 172. EASTERN PART OF KALTA-ALAGHAN AS SEEN FROM CAMP LXXXII (CONTINUATION ON THE RIGHT OF FIG. 171).

In front of us we had once more the immense basin of the Kum-köl; we appeared to be standing on the edge of a very extensive flat plain. The great mountain-ranges that we became acquainted with in our last excursion, still in part capped with snow, wore in the far-off distance the appearance of faint narrow stripes on the horizon. From where we stood the upper lake of Kum-köl was not visible;



ICE-SHEET IN THE GORGE OF KUM-BULAK.



*Ljustr. A. B. Lagrelins & Westphal.*

SOUTHERN SIDE OF TSCHIMEN-TAGH AS SEEN FROM MÖI E-KOJGHAN.



but at the distance of about 5 kilometers we saw the Kum-köl-darja winding down from it to the lower lake. It was pretty broad, for the most part frozen over, though there were also reaches of open water flashing in the sunshine. A similar flashing in the sun proclaimed the presence of yet another river in the south. The latter is the stream that issues out of the Arka-tagh, and which Roborovskij calls the Petelik-darja.

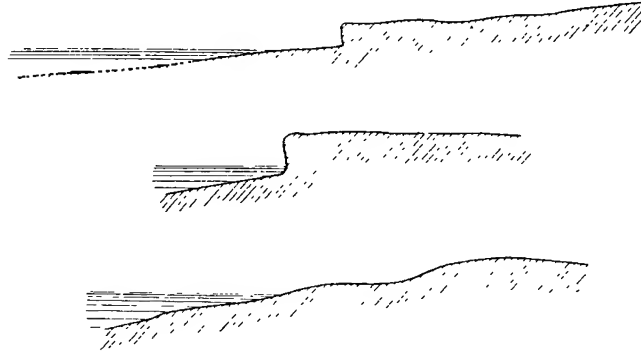


Fig. 173. DIFFERENT SECTIONS FROM THE NORTHERN SHORE OF KUM-KÖL.

Although we were travelling towards the west-south-west, we were nevertheless getting farther away from the river, for just here it seems to make a considerable bend towards the south-west or possibly towards the south-south-west. At all events it soon became lost to sight. The area of sand along the southern shore of the Upper Kum-köl had the appearance of a yellow stripe. We still hugged the granite cliffs, which have been curiously shaped by the wind into vast sheets, lumps, cubes, and domes, into tabular masses, basins, and cup-like hollows (making comfortable easy-chairs), into necks with big heavy heads, indeed in two or three places the thin walls of granite are perforated with holes, so that we were able to see right through them. They frequently had the appearance as if a viscous fluid had been poured out from above and had settled in successive layers resting one upon another. A brook, issuing from a steep ravine, gradually develops at the foot of the mountain and carves out for itself, through a flattened offshoot, a channel that is not more than 1 m. broad, though a couple of meters deep. We passed on our left two small and insignificant peaks belonging to this same offshoot. The surface of the ground was strewn with detritus and fragments of rock, more or less wind-worn and rounded. After passing on our right the entrance of a glen which appeared to start from the crest of the Kalta-alaghan, we drew away from the mountains and made our way down into the lowlands by the recently mentioned eroded watercourse. The detritus grew less and less in quantity and finally gave out altogether.

We now had the Ajagh-kum-köl in front of us, to the west and west-south-west, looking like a narrow blue ribbon on the horizon. We were here unable to see the quarter in which the Kum-köl-darja enters the lake. The country east of the lake consists of moist schor, a tract that is without doubt under water during the summer. There were a few occasional patches of wretched grass and scrub

plants. At Camp LXXXII we dug a well; it yielded water, with a slightly saline flavour, at a depth of 1.42 m. The water rested upon blackish blue clay and had a temperature of  $+0.9^{\circ}$ . The ground itself was frozen to a depth of 0.36 m. The altitude was 3878 m.



Fig. 174. VIEW FROM THE NORTHERN SHORE OF AJAGH-KUM-KÖL.

From Camp LXXXI the grey to light green granite prevailed all the way up to the pass, where it was succeeded by red granite of moderate-sized grain, and this continued right through the mountains. At the right-hand side of the mouth of the southern glen this rock is interpenetrated by a number of veins of a close, hard pitch-black rock, about 1 m. thick, probably diabase. On the left-hand side too there are similar black bands disposed parallel with the bottom of the glen, showing up in sharp contrast against the red granite. These veins run from north-west to south-east and dip  $65^{\circ}$  towards the N.  $35^{\circ}$  E. Frequently they lie so close together that the intervening granite is not more than one or two meters in thickness. The diabase is harder and fresher, and consequently stands out in relief; while on the other hand the granite is severely weathered, and that to an increasing extent in proportion to the thinness of the bands between the veins of diabase.

November 17th. We started to travel west, having the mountains on our right and the eastern *schor* shore of the lake on our left. But it was often impossible to determine whether it were *schor*, salt, or ice that stretched away from the south shore; at all events the surface was as level as a floor. Such level ex-

panes as these could only be occasioned by overflows of the lake, with consequent deposition of sediment. According to the statements of my guides, the level of the lake is in summer considerably higher than it was then, and in fact the marks on the ground showed distinctly how far the water-line had extended; all the way we were able to discern an extremely flat strip of sediment rising but little above the surface of the water. In the far east this strip of sediment is as much as 400 m. broad, but afterwards it narrows down to 100 m., 50 m., and finally it ceases altogether where the shore is shut in by a steeper rampart. This strip of sediment embraced here and there small frozen pools and lagoons, and exhibited unambiguous evidences that the lake had shrunk somewhat since the summer. Such small quantity of grass as there was at Camp LXXXII soon came to an end, and the scrub also grew scantier. After that the dry ground at the east end of the Kum-köl, which consists of sand and soil, is absolutely barren. Where the mud was moist and frozen we had a good hard path to travel on, but generally the frozen crust was so thin that the horses trod through it.

The southern slope of the Kalta-alaghan now stood out before us in its full length, extending westwards in wild, fantastic cliffs without any snow. Occasionally its flanks are pierced by transverse glens. Some small bluffs appeared to be quite detached and separate from the main mass of the range. The saj slopes up gradually from the foot of the mountains; this flat detritus scree appeared to narrow somewhat towards the west. Rather low hills extend along the southern shore.

A very distinct gap which we saw in the crest of the Kalta-alaghan was said to answer to the Amban-aschkan-davan, and south-south-west of it we reached the eastern part of the lake, the shore of which runs west-north-west. We were travelling on the recently mentioned strip of sediment, having on our immediate right a plainly marked terrace of about a meter in height, entirely barren on the surface and scored by a multitude of gulleys. The high water reaches up to the foot of the terrace, and below the latter there were springs then flowing, the water they yielded being almost fresh and encircled by large sheets of ice. Here and there the salt lay however in cakes and sheets about an inch thick. The lake was here open, except in the smaller sheltered bays and creeks, and the shore was mostly strewn with thin strips of ice flung up by the movement of the waves. Farther on the terrace passes into a more rounded rampart standing back a few meters from the existing water-line. At Camp LXXXIII there was not a trace of grass, only at the most an occasional scrubby plant as hard as wood, which we found useful for burning. Along the shore lay a narrow fringe of driftwood, of the same scrub, but it was wet and rotten and impregnated with sand. We saw no wild animals in this desolate region.

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## CHAPTER XIV.

### THE AJAGH-KUM-KÖL AND THENCE TO PASCHALIK-SAJ.

On 18th November we paddled diagonally across the lake, steering S.  $53^{\circ}$  W. from Camp LXXXIII, towards a small glen in a low range of hills that stood a considerable distance back from the lake. The breadth of the lake along the line we steered was 19,9 km. During the first half of the journey we came into contact with an ice-field, which reached unbroken all the way to the southern shore, to which it was fastened. The whole of the eastern part of the lake was covered with similar ice. Where we came into contact with it, the ice was at the most 1 cm. thick, though generally less; while sometimes it consisted simply of small pieces piled one upon the other, making a soft ice-slush, which moved as the breakers moved. Prschevalskij called this lake Nesamorsajuschtscheje or the Non-Freezing. In the light of my own experience this name is not quite appropriate. At its eastern end the lake is entered by the river Kum-köl-darja, which issues out of the Bash-kum-köl, bringing with it the spring-water with which this last is fed. The fresh water spread itself out in a thin sheet over the salt water of the Ajagh-kum-köl and froze, the freezing being no doubt facilitated by the drift-ice, which probably just at this season travels by the Kum-köl-darja into a lower lake. When the wind is in the east, this ice will be carried a pretty long way out into the lake, and so will render easier the freezing of the fresh surface-water between the separate ice-fields. At that time the water out in the middle of the lake had a temperature somewhat under 0, namely  $-0.3$ , while the water at the bottom, at a depth of 14 m., was  $\pm 0^{\circ}$ . It may be accepted as pretty certain, that the eastern part of the lake freezes every winter, provided the weather is not too stormy; when it is, the ice is broken up time after time and driven back towards the mouth of the river by the usual westerly winds. The outside edges of the ice-field that we now struck against broke readily under blows from our paddles, but towards the southern shore the ice grew thicker. Generally the entire field will no doubt during the course of the winter increase sufficiently in thickness to withstand the westerly gales and the heavy »seas» they produce, as they drive from end to end right across the lake. My boatman, Tokta Ahun, declared, that he had heard hunters say, that later on in winter the entire lake becomes frozen over; and his own opinion was, that it only needs a couple of days' wind from the east, followed by calm weather and severe cold, for that result to





*Photo. A. B. Lagodius & Westphal.*

THE ROCKY GROUND WEST OF CAMP LXXXV, NORTHERN SHORE OF AJAGH KUM-KÖL.



follow. The ice that was then driven out into the lake would come together and form a continuous sheet, which, if only the cold and the calm weather continued sufficiently long, would be able to withstand the storms successfully.



Fig. 175. VIEWS OF THE NORTHERN SHORE OF AJAGH-KUM-KÖL AT CAMP LXXXIII.

But the question of the definitive freezing of the Lower Kum-köl can only be settled by a winter visit. Under any circumstances the name bestowed upon the lake by Prschevalskij can only be set down as extremely unsuitable; moreover it is quite superfluous, for the lake already possesses a native name of its own.

During the latter portion of the trip we were forced by a hard wind from the west-north-west to take the shortest cut to the southern shore; hence we paddled first south, then south-south-east. In this last direction the shore was quite free from ice.

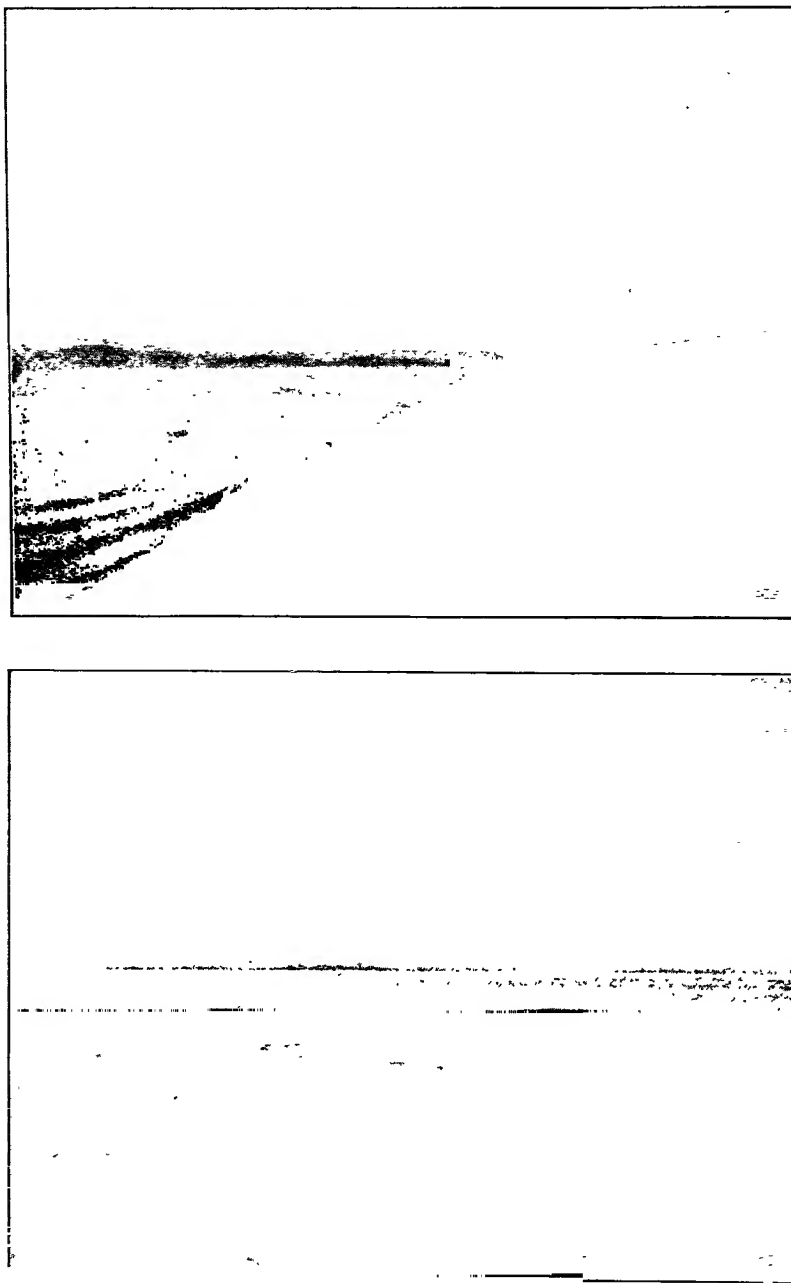


Fig. 176. VIEWS OF THE NORTHERN SHORE OF AJAGH-KUM-KÖL AT CAMP LXXXIII.

The soundings we obtained were as follows: 1.92, 2.84, 3.03, 3.44, 3.94, 4.62, 5.24, 6.05, 7.13, 8.49, 10.29, 12.38, 14.00, 15.56, 16.59, 17.52, 18.94, 19.63, 18.62, 17.94, 16.75, 9.81, 5.48, 4.90, 4.29, 3.78, 3.25, 2.83, 2.36 and 1.46 m., the last-quoted depth being taken at rather more than a kilometer from the shore. At the same distance

from the northern shore the depth amounted to 3 m. The greatest depth along this line occurred almost in the very middle of the lake, and it amounted exactly to 19.63 m.

The southern shore-line is pretty straight, without bays or peninsulas, and is composed of coarse sand. On the other hand the lake-bottom appeared to consist of fine mud; at least I infer this from the lead getting fast in it and having to be pulled out with a jerk. The Kum-köl-darja does indeed issue clear out of the upper lake; but the distance between the two lakes is so great that the river picks up on the way a great quantity of solid matter from its bed and its banks, and in addition it is also joined, as we have already seen, by at least one large tributary from the Arka-tagh on the south. Anyway during the summer it brings down with it a large quantity of sediment, which is deposited in the eastern part of the Lower Kum-köl. I have no doubt it was fine river-mud of this character in which the lead sucked itself fast.

A step-like terrace similar to that which exists on the north-east shore stretches also along the south side of the lake. On the whole it is only about 1 m. high, and was at that time not more than a couple of meters from the water-line. Sometimes it is perpendicular, sometimes it passes over into a rounded rampart (see fig. 177), and on the inner side of this there is generally a slight hollow. About 2 km. from the southern shore there is a ridge of low hills, level on the top. These were pierced immediately south of Camp LXXXIV by a ravine, with a watercourse along the bottom, which sometimes would seem to carry water. The level space between the hills and the shore is thickly covered with köuruk plants. Signs of kulans were abundant and the vast number of wild-goose feathers lying scattered about seemed to indicate that here temporary springs sometimes gush out. The lake however was perfectly barren, and, so far as I could make out, was utterly destitute of both animal and plant life.

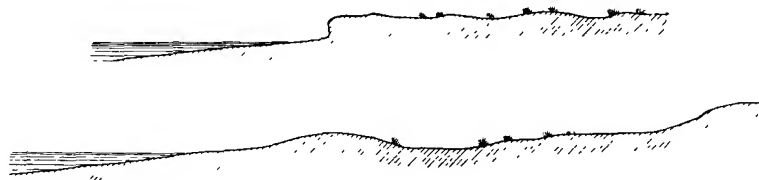


Fig. 177.

On 19th November, after a cold night in which the thermometer went down to  $-22.1^{\circ}$ , we again crossed the lake, steering towards the snow-capped peak H in the Kalta-alaghan, which appeared in the N.  $27^{\circ}$  W. Along this new line there was not a single sign of drifting ice, nor did we notice any in the east: probably the thin sheet which we saw the day before had been driven back by the westerly wind towards the river-mouth. While the temperature of the air was  $-12^{\circ}$ , the temperature of the surface-water was  $-0.45^{\circ}$ , and of the bottom-water at a depth of 20.98 m. was  $-0.32^{\circ}$ . One would suppose that the whole of this not particularly deep mass of water would, at any rate by the latter half of the winter, and

notwithstanding its considerable percentage of salt, have cooled sufficiently for the surface layer to freeze.

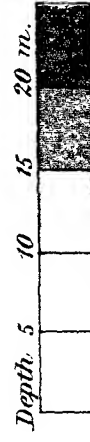
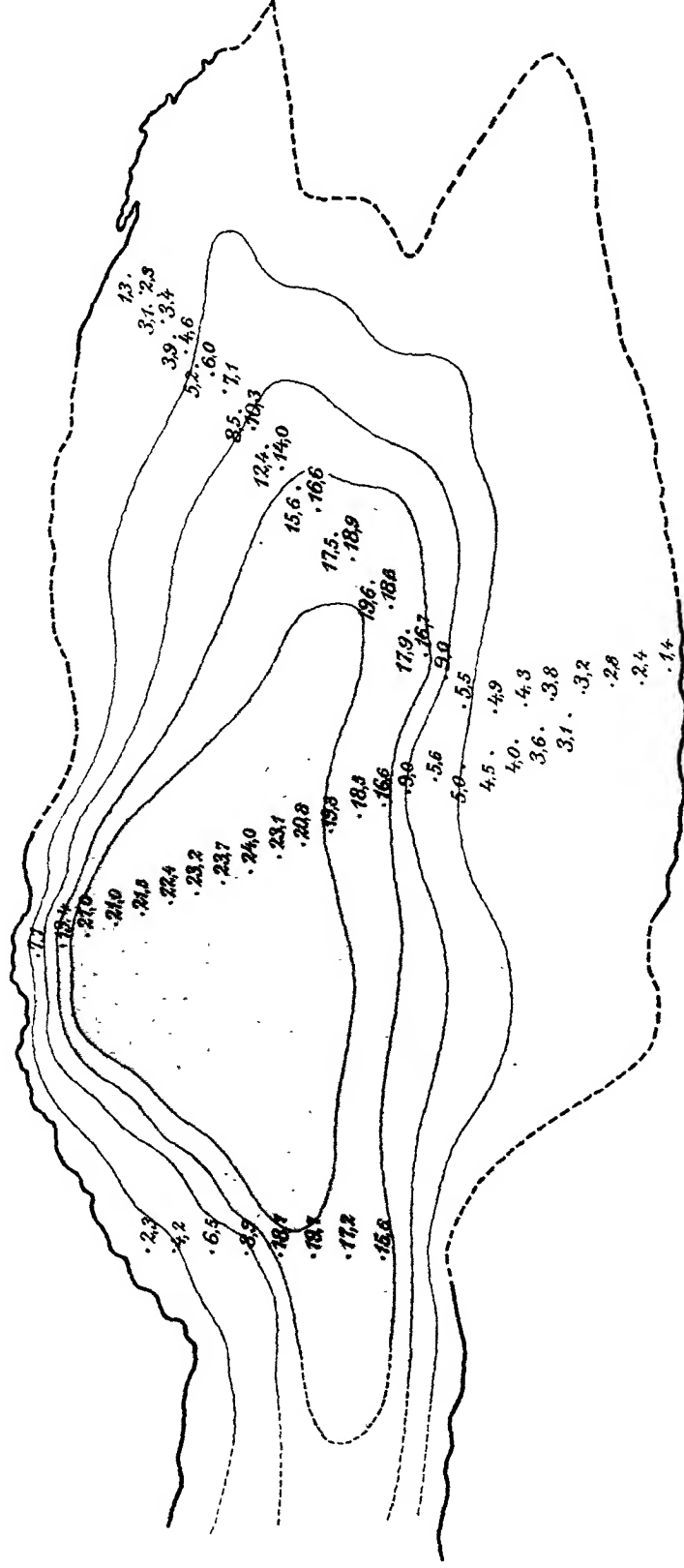
The soundings we secured along this new line were as follows: 3.17, 3.63, 3.95, 4.48, 4.99, 5.60, 9.03, 16.66, 18.58, 19.88, 20.98, 23.07, 24.03, 23.67, 23.16, 22.40, 21.52, 21.01, 21.00, 19.11, and 7.75 m. Thus at first the depth increased but slowly, but afterwards more quickly until it reached its maximum of 24.03 m., this being a good deal nearer to the northern than to the southern side. From this deep trough the bottom of the lake rises slowly towards the northern shore, until at only 1.25 km. from it the depth is again 19.11 m. Thus the northern part of the lake is deeper than the southern; nor could anything else be expected when the general shape of the great Kum-köl basin is borne in mind: the Kalta-alaghan being relatively close to the northern shore, while the first chains of the Arka-tagh rise at a considerable distance from the southern shore. Between the southern shore and the deep trough there is curiously a steep slope, which presented precisely the same characteristics and occupied precisely the same position along both lines of soundings; but then they happened just there to approach pretty close together. Along the eastern line, proceeding from south to north, we have the soundings 5.48, 9.81, and 16.75 m., while along the western line the corresponding soundings were 5.60, 9.03, and 16.66 m. In other words in a distance of only  $1\frac{1}{2}$  km. the lake drops 11 m., while from the southern shore to the edge of this abrupt declivity, a distance of  $5\frac{1}{2}$  km., the fall is only 5.5 m.



Fig. 178. THE NORTHERN SHORE OF AJAGH-KUM-KÖL AT CAMP LXXXV.

# Isobathic map of Lower Kum-köl

SCALE 1:2000000







Upon reaching the northern shore, we skirted it to the west-south-west for a distance of 7.5 km. It was slightly indented with wide bays separated by capes. The shore-line here was accompanied throughout by a terrace, which ran now a couple of meters, now twenty meters, from the water's edge and was pierced by a countless number of ravines, all running down to the lake, though at this time they were naturally dry. This terrace too, like that on the southern shore, is broken at intervals and its place taken by a rounded rampart. Farther west it frequently plunges sheer down to the water's edge or is separated from it by an excessively

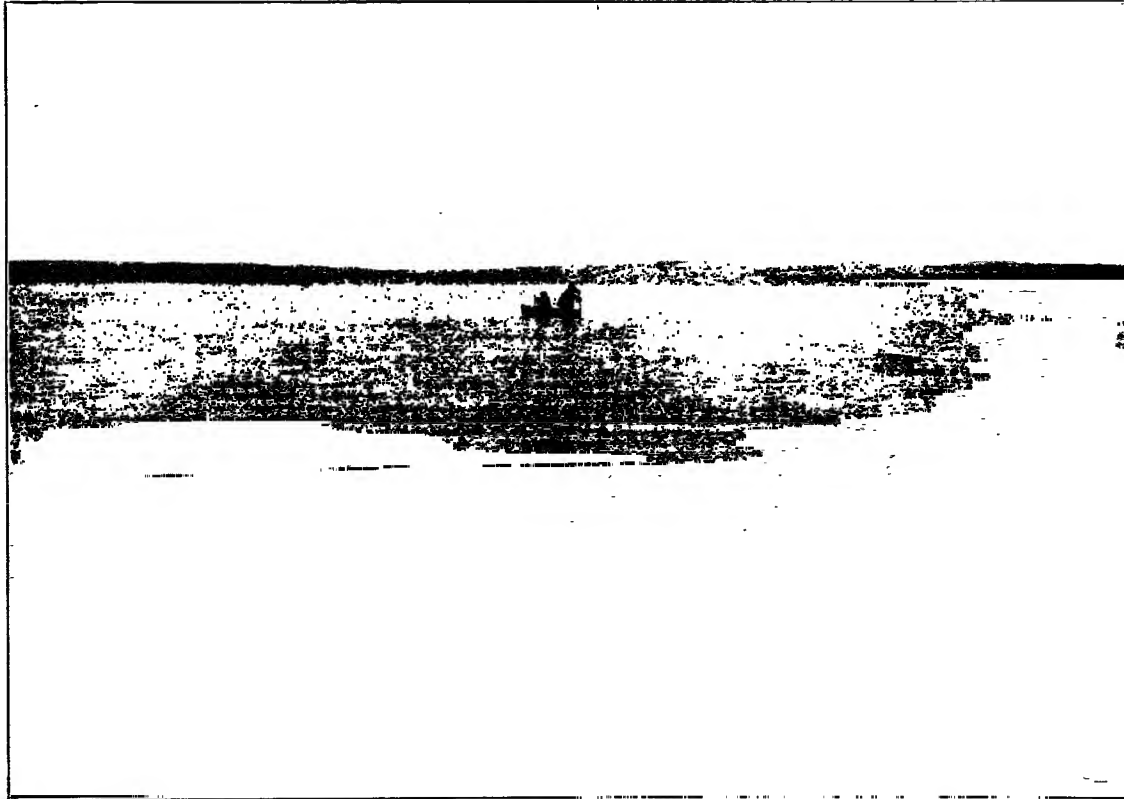


Fig. 179. THE SOUTHERN SHORE OF AJAGH-KUM-KOL AS SEEN FROM CAMP LXXXV; HERE THE LAKE IS RATHER NARROW.

narrow strip of shore. At a very short distance from the shore the depth of the lake often amounts to two or three meters. The shore is littered with patches of detritus and sand cemented together and as hard as conglomerate. From the lake-shore the surface rises extremely slowly and with insignificant irregularities to the foot of the Kalta-alaghan. It is from that range that the dry torrents issue which upon approaching the lake spread out delta-like into an endless number of gullies. A larger watercourse enters the lake a little east of the point where we struck the north shore after sounding our second line. This watercourse gives rise at its embouchure to a delta of several arms the delta entering some little distance into the lake. During the latter part of the excursion the usual transverse terraced swelling was absent, its place being taken by a gentle shelving of the shore. Camp LXXXV

was pitched on a short, stumpy peninsula, with a surface of hard, white schor. The grazing in the vicinity was miserably poor and scanty; but there was a spring with drinkable water. From that point we saw the snowy peak H to the N.  $11^{\circ}$  E. and the glen we had aimed for to the S.  $1^{\circ}$  W. To the N.  $83^{\circ}$  W. we had the culminating point I of the little mountain that is situated on the northern shore of the western part of the lake.

The salinity at this camp was precisely what it was at Camp LXXXIII, although one would have expected it to be higher, because the latter camp lies so much nearer to the mouth of the stream. The salinity will however no doubt vary with wind and weather. At Camp LXXXV the surface water had a temperature of  $+0$  in the middle of the day, when the sun beat upon it, and at a spot quite close to the shore; out in the middle of the lake it was no doubt colder. There was a faint breeze from the east; the winds here appeared to be less regular and decided than in the interior and in the southern parts of Tibet.

From this camp we sounded a third line across the lake towards the S.  $20^{\circ}$  W., and although we did not carry it all the way to the southern shore, we advanced beyond the trough in the middle. The soundings we obtained were 2.27, 4.18, 6.52, 8.96, 18.75, 19.70, 17.23, and 15.59 m. At this last sounding, a distance of 6 km. from our starting-point, we turned back; the distance from the same point to the southern shore was somewhat less than 6 km. Comparing our three series of soundings, we find that the eastern gave a maximum depth of 19.63 m., the western of 19.70 m., and the middle series a depth of 24.03 m. We may infer therefore that this last line was run approximately over the deepest part of the lake, and that from that point the lake bottom ascends, though very gradually, both east and west. I think it is pretty certain that there is no depth east of the first line we sounded equal to 19.63 m., for it is in that part of the lake that the alluvial sediment is accumulated which the river brings down in suspension; while as for the extreme eastern end of the lake, it is evident, both from the shape of the waves and the colour of the water, that it must be shallow. The shape of the lake renders it probable that to the west of the western line of soundings there is no depth that exceeds 19.70 m., for in that quarter the lake contracts and not far from the little detached mountain I terminates in a shallow bay, with which we shall form a nearer acquaintance lower down, because it was on its shore that we encamped in June 1901.

The number of soundings which I had an opportunity to take in the Lower Kum-köl — 50 in all — is not sufficient for a lake that measures 734 sq.km.; but since we have nothing better, we must make the best use of it we can. Thus we find that the mean depth of the lake is 11.42 m., and this may be accepted as being pretty near the actual figure, when we bear in mind the regular shape of the basin as revealed by the sounding lines.

November 22nd. The lake having been examined, the next thing was to return to Temirlik, crossing on the way over the Kalta-alaghan and the mighty range which forms the westward continuation of the Akato-tagh. Accordingly, leaving the lowest point (3867 m.) in the basin of the Lower Kum-köl, we travelled first towards the west-north-west, skirting round the northern base of the little detached mountain I. This, upon a closer acquaintance, turned out to consist of several small rocky por-

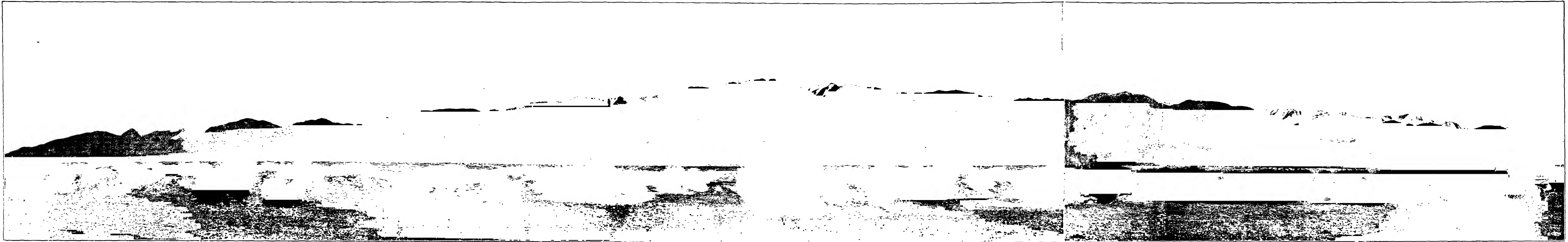


PANORAMA OF KALTA-ALAGHAN FROM CAMP LXXXII.

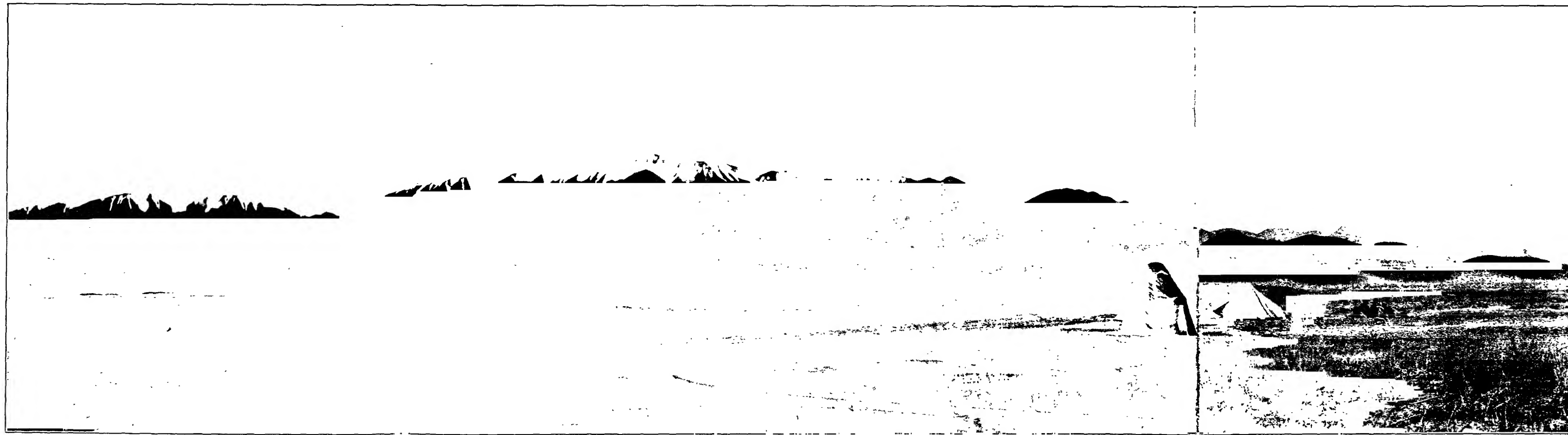


PANORAMA OF KALTA-ALAGHAN FROM CAMP LXXXIII.





THE ILVE-TSCHIMEN FROM THE NEIGHBOURHOOD OF JUSUP-ALIK.



THE ILVE-TSCHIMEN FROM CAMP LXXVIII.





tions, or rather it made a short but broken chain stretching east and west, parallel to the Kalta-alaghan and the long axis of the lake.

The principal portion lies in the middle, and has two smaller bluffs to the east, separated from itself by a broad glen, while on the west it is continued by a chain which grows steadily lower. These several portions all rise rather abruptly from the flat detritus plain. The mountainous parts are footed all round by a gently sloping talus, furrowed by small dry torrents.



Fig. 180. CAMP LXXXVI.

Once we were past this detached mountain, we again commanded an uninterrupted view of the blunted bay at the western end of the lake. Its shores are low, possess no terrace, and are often white with salt. To the south and south-south-west we saw, at a distance of about 10 km. from the southern shore of the lake, a low reddish crest, from the foot of which the surface slopes gradually down to the lake. For some distance immediately north of the westernmost part of the detached mountain we kept along a flat ridge, which slopes away very gently to both east and west. West of that divide all the brooks converge upon a stream that enters the lake's western bay, while to the east of the same they gather into a similar stream which issues from the Kalta-alaghan and enters the lake in the vicinity of Camp LXXXV, although, to judge from the appearance of the bed at its lowest part, the water seldom succeeds in getting down as far as the lake.

Beyond the main stream that enters the lake's western bay, and along the westward continuation line of mountain I, there rises a similar small detached mountain, lower than its neighbour, but spread out wider, and, as it appeared from the distance, covered with sand. Approaching the southern foot of the Kalta-alaghan, we crossed over the main channel just mentioned shortly after it emerges from a transverse glen, and then entered the nearest transverse glen, which at first ran north-west, but soon

changed to the west. The ascent was pretty steep and the drainage stream of the glen had to make its way amongst the precipitous terraces — a labyrinth of deeply cut gorges choked with masses of detritus and stones. The country on both sides, being greatly broken, was impassable. In the mouth of a wild side-glen coming down from the north, we found a sheet of ice just below a spring. Higher up in the main ravine we likewise found similar patches of ice. The stream formed there a narrow gorge through the granite; we made our way along the left-hand terrace. The pass, which is situated quite close to the Kum-köl side, and forms a very flat and easy arch, reaches an altitude of 4400 m. The descent towards the west-north-west, over on the other side of the pass, is incomparably more gentle and the glen itself wide, open, and easy. Camp LXXXVI was formed beside a spring (4348 m.), likewise surrounded by sheets of ice.



Fig. 181. WHERE THE GLEN OPENS OUT UPON THE BIG VALLEY BETWEEN THE TSCHIMEN-TAGH AND THE KALTA-ALAGHAN.

The detached mountain I was composed of a very hard, finely crystalline, dark green rock, dipping  $86^{\circ}$  towards the S.  $50^{\circ}$  W., so that the strata stood almost vertical and most of the small offshoots of the mountain stretched towards the N.  $40^{\circ}$  W. As soon as we entered the Kalta-alaghan however the predominant rock was granite of every variety, first grey, then red, green, etc. The watercourses on both sides of the pass were cumbered with fragments of granite, mostly grey and rounded by the weather.

November 23rd. From our last camp the glen inclines slightly to the south. To the S.  $80^{\circ}$  W. we saw a huge pyramidal peak, which we had also beheld from the lake; while to the S.  $89^{\circ}$  W. there was a second peak similar to it and situated to the north of it. Apparently these both belong to the same meridional mountain range.





THE VALLEY OF AKATO-TAGH. NORTH OF GHAS-KOL.



*Ljustr. A. B. Lagrelus & Westpaul.*

ENTERING THE VALLEY BETWEEN PIASLIK AND KALTA-ALAGHAN, WEST OF CAMP LXXXVI.



Our glen continued to widen out and eventually debouched upon the valley that lies between the Tschimen-tagh and the Kalta-alaghan; while its watercourse joins the main river that flows down the valley in question. This last then turns south, and after describing a wide curve to the south-east makes its way to the western shore of the Ajagh-kum-köl. At the point where we emerged upon the great valley the lake was not visible, although we could see the small range that rises on its southern shore. Thus I was able to substantiate the fact, that the Kalta-alaghan terminates not far west of the unnamed pass which we had crossed over the day before, as well as the fact that the latitudinal valley between the Tschimen-tagh (that portion of it which is called the Piaslik-tagh) and the Kalta-alaghan (or Amban-aschkan) — a latitudinal valley which has almost wholly an east-west direction — nevertheless curves round towards its western end and ends at the lake. Here it widens out very considerably and forms a spacious open plain, engirdled by mountains, though at a great distance away. Just below the point of junction between our transverse glen and the main valley there stand in the latter some small detached hills, the bases of which are touched by the winding watercourse, then dry.

We rode along the bottom of this last, up the main valley towards the north-east. The valley was at this part about 8 km. wide, but it gradually contracts towards its upper end. It is flat and open, and its stream is not very deeply eroded. The ascent, without being anywhere very steep, was nevertheless perceptible. On both slopes there was a little grazing. Seen from this side, that is from the south, the Tschimen-tagh has the appearance of a low and insignificant range. Yet its northern versant presents quite a different appearance, as we ascertained when we emerged upon the valley of Toghri-saj. The reason is quite simply, that the more southerly latitudinal valley lies at a higher level than the more northerly latitudinal valley. To this question we shall however return when we come to discuss the altitude relations of Tibet as a whole. Unfortunately I had no opportunity to visit the region between the route I am now describing and the Toghri-saj. Still I do not think it is too bold a supposition, when I state that the westward continuation of the Tschimen-tagh is formed by the range which the Russians call Atschik-kol or Moskovskij. The long range is cut through by a transverse glen of the Toghri-saj. On the other hand it is difficult to make out whether the relatively low mountains that stand on the right-hand side of the valley of Toghri-saj belong to the system of the Tschimen-tagh or to the system of the Kalta-alaghan. But the fact I have already mentioned, that the latitudinal valley in which we now are bends round to the Kum-köl, renders the former supposition the more likely, for the country just there is too open to be merely a breach through the range. It is therefore quite conceivable, that the orographical system of the Kalta-alaghan does terminate immediately north-west of the western end of the Kum-köl, and that the stretch of mountains on the right of the Toghri-saj is a branch or bifurcation of the Tschimen-tagh (Piaslik).

After advancing only a few kilometers up the latitudinal valley we came to the swelling that forms its water-divide; it is extremely flat, scarce perceptible in fact to the unaided eye. On the other side of it begins the stream which we followed, and which picks up on its way a great number of contributories from the transverse

glens in the circumjacent mountains, all of them then dry. Thus it is only the extreme western part of this latitudinal valley that belongs to the hydrographical system of the Kum-köl; all the rest of it belongs to the system of the Ghas-nur.

From the divide the latitudinal valley slopes slowly towards the north-east, being also joined by a number of small side-glens as it proceeds. On the south it is fenced in by a lofty portion of the Kalta-alaghan; there was there a larger quantity of snow than on the southern side of the range. In the mouth of a side-glen on the left there were springs, which had given rise to large sheets of ice in the broad shallow bed of the main stream of the valley. After that this last contracts to a narrow passage between the granite offshoots that nearly meet from both sides. Below this locality the main stream becomes bordered by fairly accentuated terraces. After that however the valley broadens out to a very respectable width. Hitherto the Kalta-alaghan had run from south-west to north-east; here it bends and subsequently proceeds due east, while farther on, as we have already seen, it bears to the east-south-east. Consequently it is the deviation of the Tschimen-tagh which gives rise to the great expansion of the latitudinal valley; its crest appears to bend away a good deal towards the north or north-west. Still it is just possible that the portion of the Tschimen-tagh which we had hitherto had on the left does not belong directly to the main range, but is only a southern branch of it, a branch of the same kind as that which fences in the valley of Toghri-saj on the east. In the great expansion the main stream of the valley is joined by a large tributary from the left, i. e. the west. From this point onwards the Tschimen-tagh conveys the impression of being quite an insignificant range; it does not even screen the westward continuation of the Akato-tagh, the Ilve-tschimen, whose great snowy peaks tower up above it. This again is solely the effect of the greater absolute height at which our latitudinal valley lies as compared with the Tschimen valley.

From the point where the main valley changes its direction from north-east to due east, it contracts again and slopes down towards Kötäklik. Finally it unites with the eroded watercourse of the At-atghan valley, which we crossed over at Möle-kojghan on our journey out. Orographically it is of course one and the same valley, and is situated between the same mountain-ranges. The united watercourse then cleaves the before mentioned gap through the Tschimen-tagh, and then, having picked up the streams of the Jusup-alik and Toghri-saj, makes its way past Baghtokaj towards the Tschimen-köl, which however it never reaches.

In the expansion of the latitudinal valley the main stream is so broad and so shallow, that it shows scarce any trace of terraced banks. Both grazing and fuel were fairly abundant, but there was no water. Leaving the stream on our right, we approached the foot of the Tschimen-tagh across an almost perfectly level stretch of country, the surface soon sloping again towards the north. The orographical conformation is here in the highest degree remarkable and unusual. The pass of the Tschimen-tagh at Kum-bulak lies only a few meters higher than the bottom of the latitudinal valley. Its altitude is 4194 m. In other words the space between these two great ranges has been filled up with detritus and accumulated sediment to such an extent that, at all events in this section of it, the bottom of the latitu-

dinal valley has raised itself up to the shoulder of the crest of the Tschimen-tagh. After the denudation and filling up, taken in conjunction with the retrogressive erosion in the transverse glen of Kum-bulak, have in this manner been operative for a sufficient length of time, it is easy to suppose that the latitudinal valley will make a new exit for itself through the gorge of the Kum-bulak, instead of reaching the Tschimen valley, as it does now, by the same breach as the At-atghan.

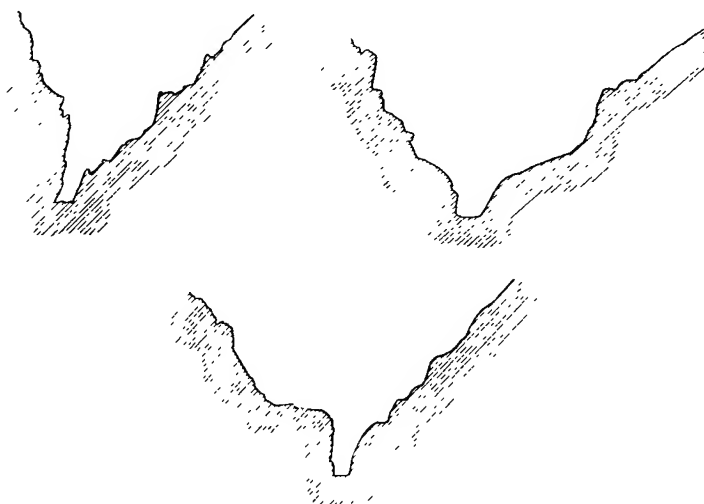


Fig. 182.

The transverse glen of Kum-bulak descends northwards from the flat pass by short steep windings, having minor granite mountains on the right; drift-sand has accumulated on the left side of the glen. In some places the defile plunges steeply over the granite thresholds that lie athwart it. It is in this wild and picturesque glen that the Kum-bulak or Sand Spring gushes out; it had filled the narrow rocky bed of the torrent with massive sheets of ice. Here, where the drift-sand came to an end, we pitched Camp LXXXVII (alt., 4051 m.). Contrary to what we found in the glen of Savughluk, where the drift-sand has accumulated in the very lowest part of the glen, we find here, that it only occurs in the highest part, the difference being ascribable to the very different form and structure of the two glens. There is however this resemblance between them, that in both glens alike the sand is piled up on the left or western side.

This day's march led us through coarsely crystalline rocks, principally red and grey granite.

November 24th. Immediately below the spring the glen brook is excessively narrow, and here we had carefully to lead the horses over to the left side across a rocky threshold in the bed, as well as carry the baggage ourselves for a short distance. The scenery was in a high degree picturesque and attractive, the granite cliffs sometimes descending perpendicularly into the glen. It is indeed astonishing that the wild and towering masses of rock through which the transverse glen has sawn its way can belong to the same mountain-range as that which we had lately seen from its southern side as a rather insignificant chain. And the farther we des-

cended into the glen of Kum-bulak. the loftier grew the rocky walls, until we reached almost the end of the glen. when they rapidly sank, sending out low spurs towards the north, to the flat plain of the Tschimen valley. Meanwhile the deeply incised

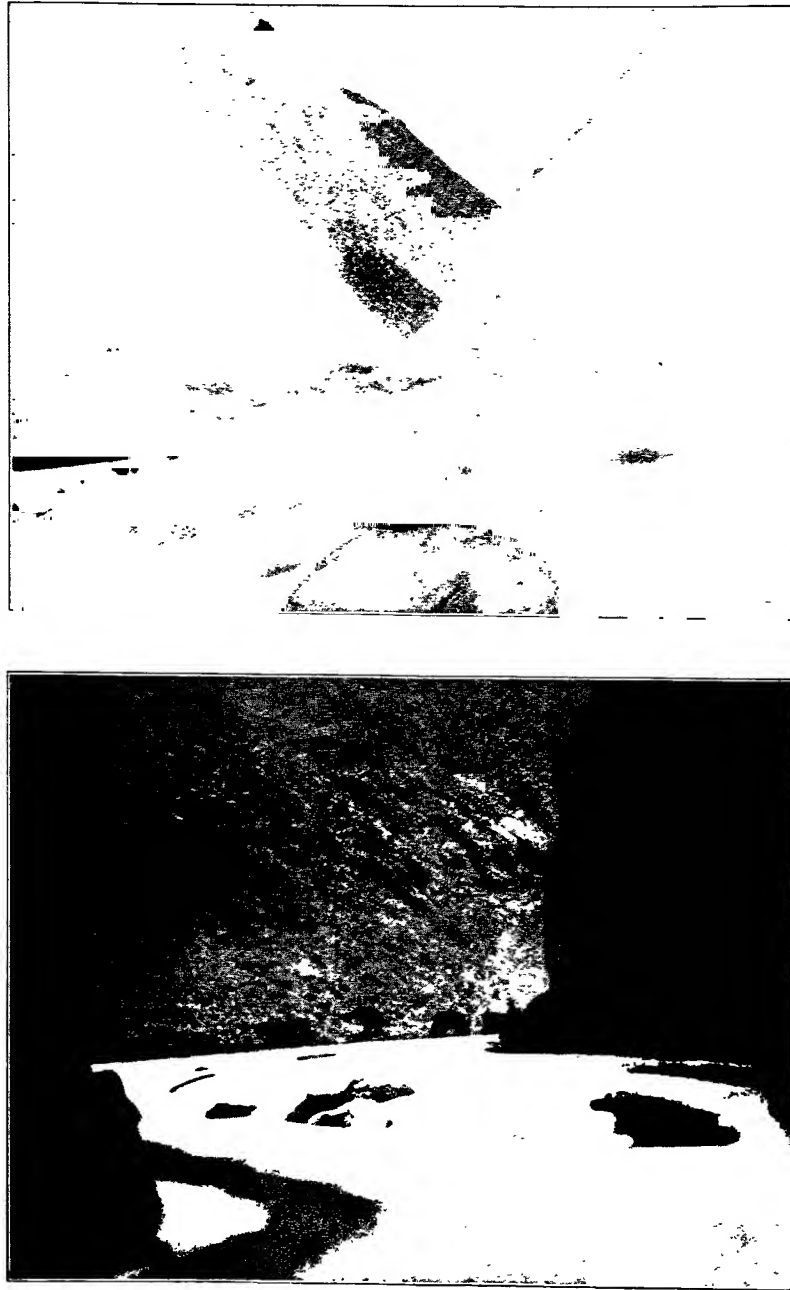


Fig. 183. VIEWS FROM THE GLEN OF KUM-BULAK, BELOW MY CAMP (LXXXVII).

glen stream descends by short quick windings towards the north-west, being met by smaller gorges and ravines from both sides. Generally the bottom is choked with rounded, polished stones and detritus that have fallen from the heights above, and frequently form steps and shelves, down which the stream (when there is one) must

race in foaming cascades. Several of these we experienced great difficulty in passing. In one small expansion the bottom of the glen was wholly covered with glassy ice, frozen in layers, the water having issued from an adjacent spring. Below that point we met with no more difficult passages. The glen has a rapid fall, as is indeed inevitable from the great difference in elevation of the two latitudinal valleys that it unites. The accompanying illustration (fig. 182) shows the usual type of its vertical section. Finally the glen widens out, and its stream acquires small erosion terraces. Just before emerging upon the Tschimen valley it is joined from the left by a couple of large side-glens. Yet strange to say, the watercourses which descend with these side-glens do not unite with the watercourse of the Kum-bulak glen; but, after approaching quite close to it, they begin to diverge, leaving between them

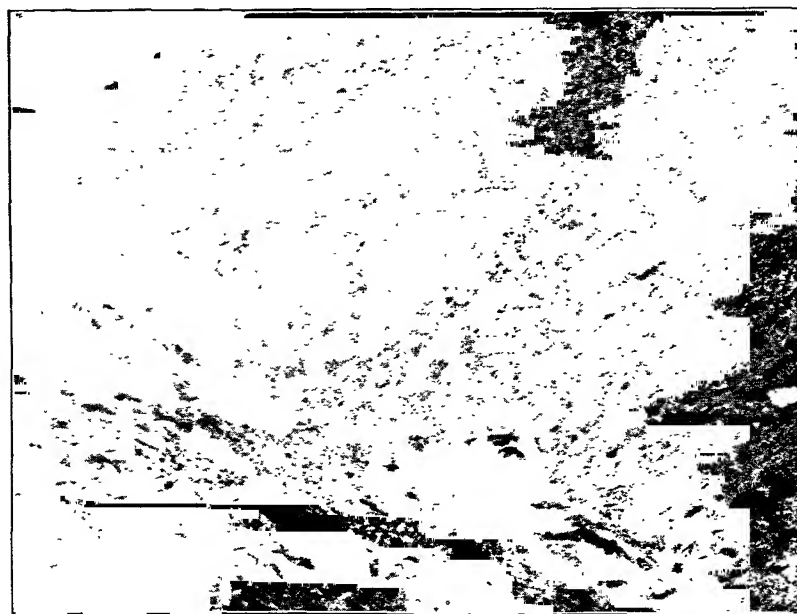


Fig. 184. VIEWS FROM THE GLEN OF KUM-BULAK. BELOW MY CAMP (LXXXVII).

a rampart or terrace, which, consisting entirely of gravel-and-shingle and blocks of stone, grows broader and broader as it descends. Thus the peculiar feature in the conformation of the region is the remarkably excentric situation of the pass. While it lies 11 kilometers from the northern foot of the Tschimen-tagh, it is only about one hundred meters from its southern foot, and little more than one kilometer from the principal stream of the latitudinal valley on that side. Thus, as in the glen of Mandarlik, practically the whole of the range lies on the northern side of the crest containing the pass, and the loftiest and biggest of its peaks are likewise situated to the north of the same crest.

From the mouth of the glen the belt of vegetation at Jusup-alik was distinctly visible to the north-north-east. At first the surface, which slopes in the direction just indicated, is plentifully strewn with detritus; but after the gravel thins out, steppe vegetation makes its appearance. The hard, level saj is furrowed by several shallow watercourses, all running towards the east. Between these water-

courses and the spring-water stream of Jusup-alik, the saj forms a very slight swelling, so slight indeed that its presence is only suspected from the watercourses. Camp LXXXVIII was pitched on precisely the same place as Camp LXXIV of our previous excursion, thus giving me a valuable point for controlling my observations.

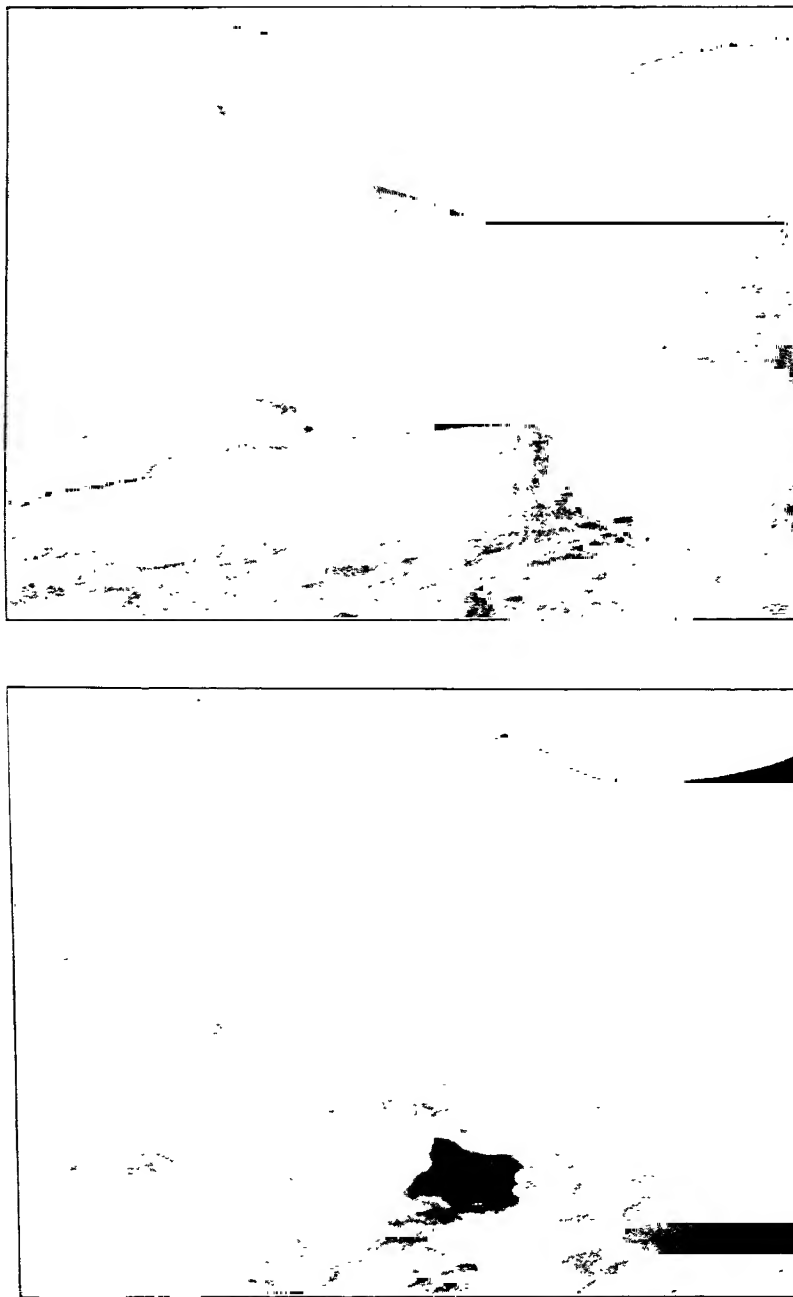


Fig. 185. SOME OTHER VIEWS FROM KUM-BULAK.

The transverse glen of Kum-bulak is, as I have said, cut through the granite, which is here of several varieties, red and grey, often bedded at  $70^{\circ}$  to the S.  $75^{\circ}$  E. At the extreme end of the glen however there is a hard dark, finely crystalline



rock, diorite or diabase, lying at  $53^{\circ}$  S. The greater part of the detritus that has accumulated at the northern foot of the range consists of this last-named variety.

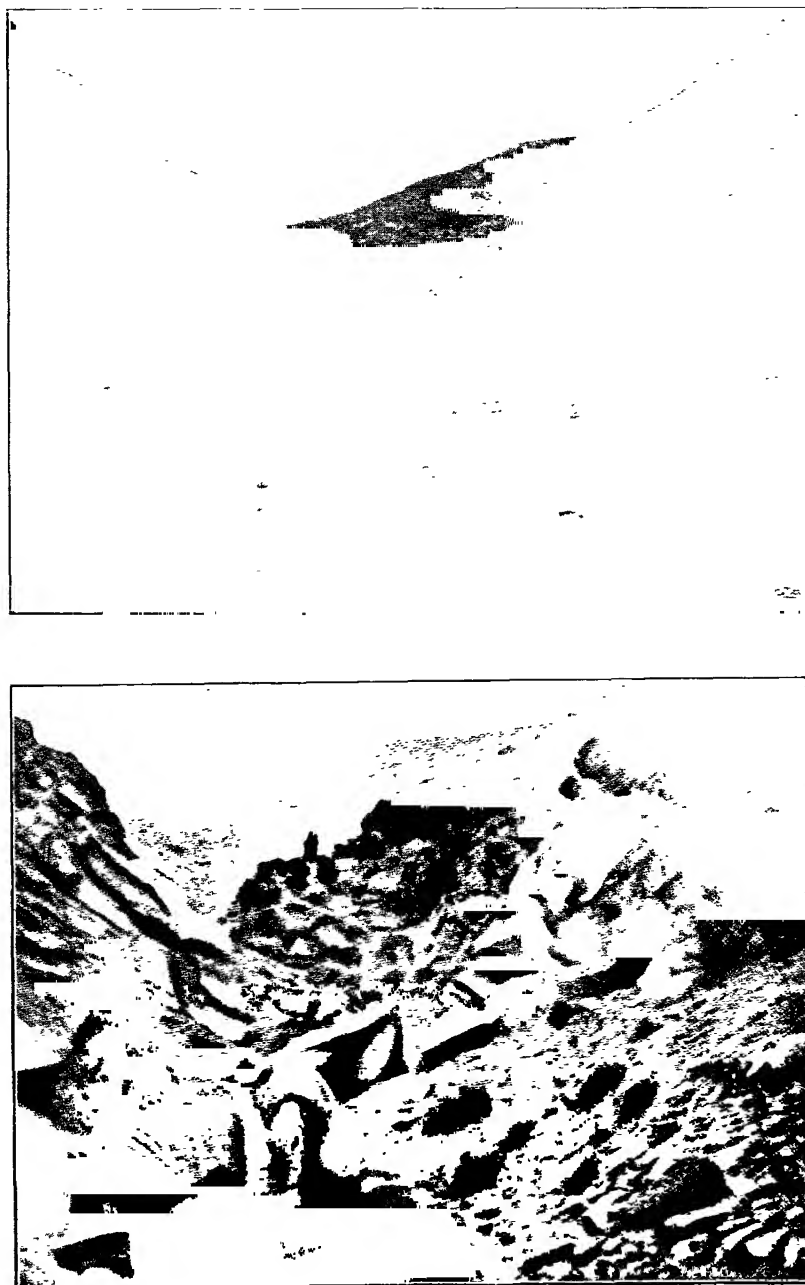


Fig. 186. SOME OTHER VIEWS FROM KUM-BULAK.

On 26th November we made quite a short day's march towards the north-east, to the last point where water and fuel were to be had. Close to Jusup-alik we crossed over a spring-water stream, which had a volume of not less than 2 cub.m. in the second. It was only frozen in one or two of its broader parts, although the cold was now decidedly keen. In several places springs gush out, and

all unite with this one, which runs towards the east-south-east to Ghaslik, where we formed Camp LXXV.

North-east of this stream the ground is hard, lumpy schor, with a thin mantling of white salt. Grass, although withered long ago, was fairly abundant. Patches of ice, some large, others small, betray the presence of springs, and show that the country is marshy in summer. Finally we reached another brook, which came from the north and ran towards the south-east to unite with the preceding stream. In the narrower reaches it was open; in other places it was covered with broad sheets of ice. This brook appeared to begin immediately north of Camp LXXXIX (3455 m.), where the surface is again hard detritus saj.

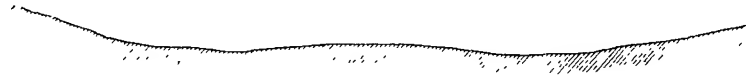


Fig. 187.

I have visited Jusup-alik at three different seasons of the year, and on each occasion there was a fierce gale blowing from the west. On this visit, 26th November, there was a half-gale, driving vast clouds of dust and drift-sand before it down the valley. Thus the same winds would appear to prevail here that are dominant in the interior and west of Tibet, where the west wind is remarkably characteristic of the winter. The cold was intense; during the night of the 27th—28th November the thermometer went down to  $-24.6^{\circ}$ .

November 28th. From the border-line of the vegetation the surface ascends at first slowly, though afterwards the slope becomes more noticeable. The scrub thins out and ceases, and the ground is buried under detritus as well as seamed by an endless number of eroded watercourses. On the right there are some low hills, on the left we perceived the offshoots of the mountain-range with the outlets of the glens between them, while above them towers the snow-capped summits of the crest. We entered a broad glen, filled with detritus in a disagreeable way. The stream that descends this glen is divided into several arms and beds; these cut their way through a series of low hills that turn their precipitous sides towards the west. Here and there we perceived a snow-drift, but there was no ice. None of my men had ever travelled by this route before; but they knew that it is sometimes used by hunters, proceeding from that locality to Tscharklik with asses. And sure enough we soon discovered traces of their presence, by which we were guided into the right glen opening. It was however a horrible road: not a single square decimeter of the surface is free from detritus and fragments of grey granite. All the side-glens and both sides of the valley are choked with masses of detritus and heaps of granite. We were once more amid the usual wild, fantastic scenery characteristic of granite formations. The glen led us towards the north-west. We encamped (alt. 4425 m.) in a locality where there was neither grazing nor water nor fuel, though there was indeed snow. Far below us in the prolongation of the glen we saw the isolated mountain of Kara-tschoka, with the stream clinging to its southern foot, and still farther off appeared the breach in the Tschimen-tagh at Kötälik, the crest of the range being just there considerably lower than elsewhere.

November 29th. Just above our camp the stream of the transverse glen forms a narrow ravine or gorge, marvellously deep and steep, sunk between precipitous granite walls and with its bottom choked with detritus and stones. The steps and platforms in its bed will of course form waterfalls after rain. This gorge is absolutely impassable; accordingly, in order to get past it, we were obliged to cross the glen, just above our camp, by means of a very steep detritus slope, the summit of which we only reached after zigzagging backwards and forwards times without end. On the other side of it we again descended into the glen, which was then wider. Shortly afterwards we came to the trough proper of the glen, or the gathering basin into which the waters, whether from springs or melting snows, collect from



Fig. 188. THE PASS OF GHOPUR-ALIK.

all directions to feed the torrent which forces its way through the gorge I have mentioned, and below which the glen again expands. The ascent, which had all the time been very steep, increased to a notable degree, while the pass became inconceivably difficult and irksome, and to make matters worse the acclivity was everywhere thickly strewn with moderate-sized gravel. The snow lay here in a thin but unbroken sheet. The pass formed such a slight depression in the crest of the range that we were hardly aware of it until we were close upon it. The peaks at each side rise but very little higher than the pass itself. The summit of the pass is narrow and sharp, and bears no resemblance to the flat arch or platform which is so common a feature of the passes on the highlands of Central Tibet. Another characteristic feature is the short and precipitous ascent. The absolute altitude amounts to 4926 m., so that this is one of the loftiest passes we essayed in northern Tibet. Its name is Ghopur-alik; Ghopur being reputedly a hunter from Tschertschen who used to come here yak-hunting.

The view was sublime, especially eastwards across the valley of Tschimen, with Kara-tschoka far below us and to the south in the distance the mighty mountain-ranges with their fringes of snow; yet there was not one glacier visible, not even of the most rudimentary type. Almost all the snow that was then in sight disappears during the late summer. The steep transverse glen up which we had just scrambled was clearly visible under our feet from end to end in bird's-eye view, while the off-shoots of the mountains on both sides had a peculiarly shortened and truncated appearance. Westwards there was a fresh world of mountain-chains, cliffs, and spurs, almost entirely buried under snow; the only spots in which the naked black rock came through were those upon which the sun beat all day.

On the west side of the pass the declivity was at first rather steep, though incomparably easier than on the eastern side; but there was just as great a quantity of detritus. We soon reached the upper gathering basin of the Paschalik-saj, and down we went towards the west-north-west and west. Just under the summit of the pass we saw on our left another pass, a good deal lower than Ghopur-alik, so low in fact that we were able to see right over it down to the flats of Jusup-alik. This second pass is however said to be inaccessible from the south.

Several of the glens that enter the upper part of the Paschalik-saj are of some importance, but all are filled with detritus, and all were dry. It was not until we had advanced a little farther down, that we discovered a spring in the main glen, its ice-sheets penetrating in amongst the masses of gravel-and-shingle. Still farther down we passed a small triangular lake, covered with bright, glittering ice. The terraced banks of gravel-and-shingle on both sides of the eroded watercourse became more developed as we advanced down the glen; often they were precipitous and a couple of meters high. Immense cliffs tower upwards on the right, or northern, side; these belong, I was given to understand, to the Ilve-tschimen. Then the glen expands somewhat, being joined from the right by a side-glen of noteworthy dimensions and of a wild, fantastic appearance. At its head we perceived imposing masses of precipitous rock, with great shelves and terraces, upon which the snow lay in long strips, looking for all the world like the galleries and decorations in a Tibetan temple. Between this glen, which runs from south to north, and our glen, which runs from west to east, there are said to stretch soft, rounded, earthy elevations, that yield good grazing in summer. At the point where the two glens unite they are joined by yet a third, coming from the south-west, namely the Buktöj-saj. From this last a track proceeds to the upper part of the Tscharklik-su, and so on down to Tscharklik; but it is reported to be difficult and awkward, crossing over several passes, so that it is only used by hunters. At the point where the three glens merge into one, and form the broad main glen of the Paschalik-saj, there is an open and spacious expanse, crossed by several converging drainage-channels. From that point the main glen assumes a more northerly direction, the component of the directions of the three constituent glens. Had the season not been so far advanced, the grazing here would have been pretty fair. Here we saw a large herd of wild-yaks. The altitude was 4057 m.

All the way from Camp XC to the summit of the pass and a good bit over on the western side the prevailing rock was grey granite. After that red sandstone



CAMP XC IN A GORGE OF AKATO-TAGH.



*Ljustr A B Lagrelus & Westphal*

THE SAME.





THE PASS OF GHOPUR-ALIK.



*Ljustr. A. B. Lagrelus & Westphal*

CLIMBING UP TO THE SAME PASS.





became prominent, lying  $60^{\circ}$  to the N.  $55^{\circ}$  W. Where it is shorn through by the stream, it crops out as hard rock; elsewhere it is generally disintegrated and pulverised, but nevertheless forms offshoots and short buttresses on both sides. At the frozen lake there was a light-green, schistose rock dipping  $88^{\circ}$  towards the S.  $55^{\circ}$  E., very soft and fracturing easily into thin flakes. Yet both here and lower down the bottom of the glen is choked with detritus and fragments of the usual grey granite. Below the frozen lake was a dark-green finely crystalline variety of rock dipping  $60^{\circ}$  towards the N.  $30^{\circ}$  E. Then followed a crystalline schist with glittering micaceous particles in its fractured faces ( $42^{\circ}$  to the N.  $5^{\circ}$  E.), but in front of it is a low ridge or shelf of striped granite or gneiss.



Fig 189. CAMP XCI.

November 30th. From Camp XCI the outlet of the glen of Buktöj-saj was visible to the S.  $70^{\circ}$  W., surrounded by imposing snow-clad mountains. That snow is not however perpetual, but disappears in the summer. The ground was now in fact everywhere covered with snow. After crossing over the watercourse, in every way considerable, of the Buktöj-saj, we travelled along the left terraced bank of the large bed of the Paschalik stream, which keeps closer to the mountains on the right than to those on the left of the glen. The detritus grew increasingly thinner and scantier, and was at length succeeded by soft earthy soil, dotted over with japkak plants; though the granite detritus still continued to cumber the bed of the stream. To the west of the spur close to which we were marching, it being on our left, there was said to be a pass, Jajlak-davan, from which a glen and a track lead down to the districts of Tughuluk-saj and Kum-taschlik. From the left there comes down yet another side-glen, its torrent brushing close along the foot of a small offshoot. Here on the right bank begins a hunters' track leading to Schia-manglaj, and a

little farther on there is a second like it. It is the great range on the right-hand side of the glen that bears the name of Schia-manglaj. A small offshoot juts out from the left-hand range down to the bed of the stream and is crossed by a small *bel* or »saddle». Below this we observed certain terrace-like steps or marks of higher flood-lines.

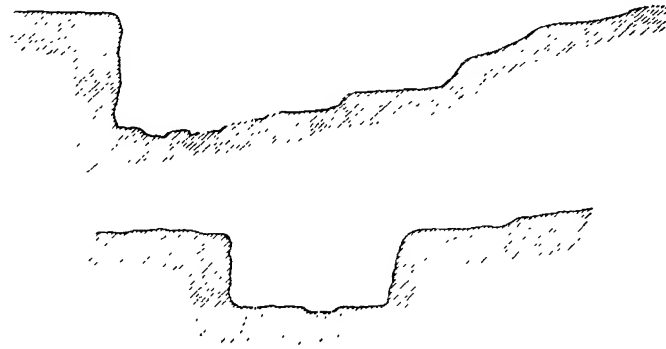
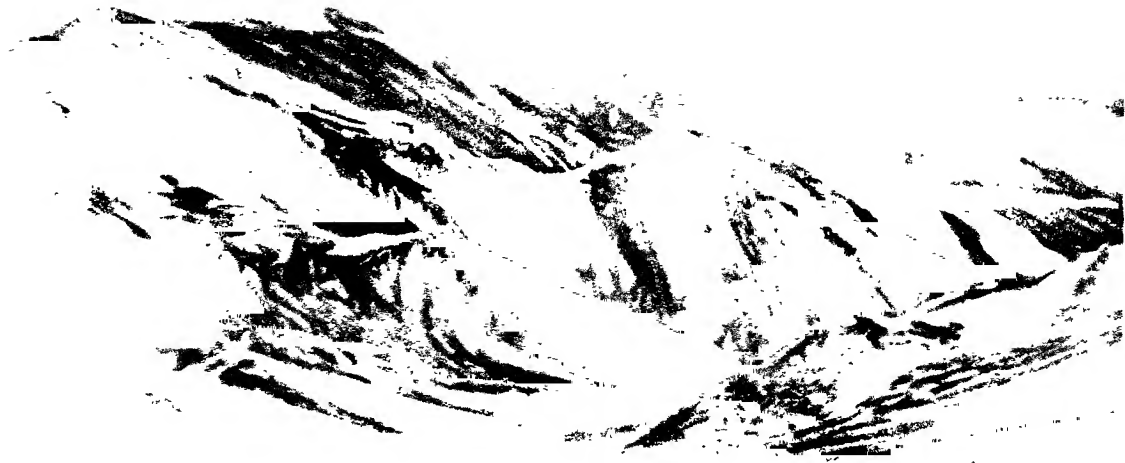


Fig. 190.

The glen of Paschalik is here broad and open, though not more than 1 to 2 km. across; its surface is soft, and its slope gentle and pleasant. The glen continues to incline to the right, until at length it runs in a northerly direction. The farther we advanced, the deeper and more energetically had the stream cut down through the gravel-and-shingle, which was of varying sizes. Sometimes there was only one vertical eroded face; sometimes there were several steps, often six, with more or less steep slopes between them. The left side is the steeper, although as a rule the channel runs closer to the mountains on the right side of the glen. The transverse sections were of course incessantly changing: now it is the right side, now the left, now both that are vertical (see fig. 190). In some places the bed is as much as 40 m. deep, and in this respect resembles the deeply eroded streams of the Kirk-saj which run down into the Tarim basin. In the summer this particular stream is said to carry an unprecedented volume, so that it can only be forded on horseback, and then with difficulty; but the fords are well-known. In an expansion of the glen it is joined from the left by a large side-glen called Otturu-buktöj, up which runs a track to Tughuluk-saj, upper Buktöj, and Tscharklik. At Tughuluk the glen of Schor-tschap is also said to terminate, though from the descriptions given me I do not find it easy to arrive at any clear conception of the mutual positions of these glens.

At a part where the Paschalik-saj is broad and plentifully provided with »steps», mostly rather steep, we made our way across it (3513 m.), and then directed our march towards the north-east, while the main glen slopes down towards the north and north-west, and farther on in that same direction unites with the *thalweg* of the Ilve-tschimen. But before the main glen turns to the north-west it first cuts through a small free-standing mountain and then picks up the Astin-buktöj from the left, a glen through which yet another track proceeds to Tscharklik. Here the glen expands, and the entire country grows more open, while at the same time the mountains on the right become broken up into small



LOOKING EAST FROM GHOPUR-ALIK.



*Ljustr. A. B. Lagrelius & Westphal.*

THE GLEN LEADING UP FROM THE TSCHIMEN VALLEY TO THE GHOPUR-ALIK



sections; but behind them and above them rises the range of Schia-manglaj, which we saw at the end of the glen. This range belongs to the Ilve-tschimen. Another broad, shallow, gravelly watercourse, after winding north-west amongst detached eminences, joins the Paschalik-saj. Here the surface is almost level and in part strewn with sand; on the other hand there was very little snow, and what there was occurred in thin, scattered patches. Here were a few teresken and köuruk plants. This district is called Schia-manglaj-lajdang. To the north-east, and thus in the angle between the Paschalik-saj and the Ilve-tschimen, we observed a spur of moderate size. It was just below its little pass that we pitched Camp XCII at an altitude of 3453 m. In the distance, to the north-east, an imposing mountain-range, the upper Astin-tagh, which we had crossed over at Basch-jol. There was no spring to be found here, though there was snow. But we were not badly off for grazing, and fuel was abundant.

Not far below our former camp we found a pink variety of rock, not unlike marble, and with a dip of  $79^{\circ}$  towards the S.  $15^{\circ}$  E., and shortly after that actual marble at  $43^{\circ}$  N. At the little *bel* in the Paschalik-saj we found a dark crystalline schist at  $65^{\circ}$  N. A similar schist, with a large admixture of mica, but rotten and readily friable, occurred in the small detached mountains, dipping  $48^{\circ}$  towards the N.  $40^{\circ}$  W. In the beds of the streams the predominant rock was, as hitherto, grey granite.

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## CHAPTER XV.

### THE GLENS AND STREAMS OF THE ILVE-TSCHIMEN AND THE ASTIN-TAGH.

December 1st. The little pass was situated only about a score of meters above our camp. From it, which the natives do not even honour with the appellation of *dazan*, but describe quite simply as *bel*, we enjoyed an extensive view to the north-east across a chaos of small mountains, groups mostly detached, and offshoots from the Schia-manglaj, which rose in all its massive majesty on the right, or south-east, of our route. At about 10 km. to the north-east, and behind the smaller ridges that diversify the right side of the Ilve-tschimen valley, lie the twin lakes of Schor-köl. The upper of these is fresh, and is said to be <sup>1</sup> 2 to 1 m. deep; while the lower is salt and not, it is reported, more than a couple of decimeters in depth, possibly therefore it is only a temporary formation. The upper lake is fed by springs, and discharges into the lower lake by a narrow canal. Both lakes were stated to be then frozen over so thickly that the ice was strong enough to bear the weight of a man. Swarms of wild-geese are said to frequent their shores in spring, where hunters go in quest of them. These two lakes clearly lie in the centre of a minor self-contained basin; and to the north-east of them there are yet other low ridges, while far off, beyond them, rises the Astin-tagh, its crest visible from end to end from the top of the little pass where we were standing.

Upon resuming our journey, we descended the pass, which was at first rather steep, though afterwards it grew flatter, and then we threaded a labyrinth of minor hills, some standing quite detached, others connected and forming short ridges on both sides of us. We encamped on the left bank of the Ilve-tschimen stream at an altitude of 3236 m. To the S. 55° E. we perceived the gap or breach in the range, through which the stream comes. This is formed by the confluence of two spring-fed rivulets, which unite at Kara-tschoka, only about 6 or 7 km. from our camp. The springs, which are perpetual, are situated a good bit above Kara-tschoka. We were told that it is only possible to proceed about half a day's journey up the glen, for the country then begins to be difficult. At our camp the stream possessed no distinctly marked bed, but was broad and superficial, and split up into a number of shallow, winding arms, several of which contained extensive sheets of

ice. The quantity of water that was still running was, on the other hand, very trifling, perhaps only  $\frac{1}{10}$  cub. m. in the second. In summer the stream is stated to swell out very considerably and to inundate the country far and wide. In our immediate locality its course was towards the N.  $12^{\circ}$  W., and I was told that lower down it contracts into a narrow and well-defined channel. Here were some bushes and teresken, but lower down the jajlaks are said to be so good that the shepherds visit them in the summer. To the N.  $7^{\circ}$  W. rose a more conspicuous part of the Astin-tagh; and just east of it, on the northern side of the range, the transverse glen of Jajlik-saj is said to have its beginning or *baschi*. This glen runs northwards down to the lowlands of East Turkestan.

At Camp XCII we found a dark schist, rich in mica and greatly compressed, dipping  $78^{\circ}$  towards the N.  $33^{\circ}$  W.; while east of the pass there was a similar, but rather harder and lighter-coloured, schist at  $83^{\circ}$  E. This schist predominated from that point all the way to the Ilve-tschimen valley.

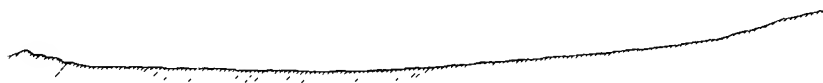


Fig. 101.

All day on December 2nd we travelled east, with an inclination to the south. At first we ascended slowly. The grass began to give out and eventually came to an end, and was followed by saj, with gravel and sand and a sprinkling of scrub. A track branched off to the left, over a stretch of low hills, to the Schor-köl. From a minor pass (3303 m.) that we had to cross over, we saw to the south-west a level expanse, with withered grass, beside the more easterly of the two branches of the Ilve-tschimen. From this new bel the view eastwards was boundless: we were able to follow the Astin-tagh until it dwindled away as fine as a needle in the far, far distance. On the south rose two stupendous bluffs of the Schia-manglaj, with the *baschi* of the Mandarlik-saj between them. But towards the east the mass of the Schia-manglaj grew lower and lower. The name of Schia-manglaj appears, properly speaking, to designate the northern and eastern parts of the great mountain complex of the Ilve-tschimen, although the latter name is used to indicate the valley in which we last encamped.



Fig. 102.

From this saddle the surface slopes very gently, with long and scarce noticeable undulations, though we kept pretty nearly to the same level. From the top of a small hill we saw to the N.  $12^{\circ}$  W. the twin lakes of Schor-köl, with a little withered grass round them; we also saw, to the north-east, the beginning of the spring-fed rivulet that supplies the upper lake, and even in winter carries a little

water. On the right, i. e. to the south, we had, quite close at hand, several minor, dark-coloured spurs; but these gradually came to an end, allowing the flanks of the main mass of the Schia-manglaj to advance to the bottom of the main valley. Below them there are only a few small free-standing bluffs: while on our left, i. e. to the north, but farther away, were several similar ridges and chains of hills, of a red colour. But all such minor elevations ceased before we reached Mandarlik; and the long sweeping lines of the broad *kajir* valley (fig. 191), with its surprisingly gentle fall and almost straight run, were conspicuous in the east. The surface was furrowed by only a few dry watercourses, gravelly, shallow, and small, which issued from the nearest mountains on our right. To the east-north-east we saw the Kala-köl and



Fig. 193. CAMP MANDARLIK.

to the east-south-east the Usun-schor. The Mandarlik-saj, on the left bank of which we pitched Camp XCIV (alt., 3255 m.), is deeply and energetically excavated, though both its depth and its breadth vary greatly (fig. 192). At this camp it was 70 m. broad and 3 m. deep. Here the glen approached from the S.  $23^{\circ}$  E., but its baschi or head is situated in the S.  $41^{\circ}$  W., whence the glen describes a curve down to the Kala-köl, that is to the N.  $30^{\circ}$  E. A thin layer of drift-sand has formed on the slopes above its left terraced bank, an indication that here too westerly winds prevail. The Mandarlik-saj belongs entirely to the great mass of the Schia-manglaj; its bottom is choked with granite detritus, but was then perfectly dry, although it would appear to carry a very considerable flood in the summer, and this will no doubt cause the Kala-köl to swell out to a greater extent than it had reached at the time of our visit. The only vegetation on its banks were teresken and köuruk. The Mandarlik-saj constitutes a separate hydrographical system to itself, a self-contained basin with its own terminal lake. This basin is separated by a swelling from the eastward-flowing





THE USUN-SCHOR AT CAMP XCV.



*Ljustr. A. B. Lagrenius & Westphal*

THE USUN-SCHOR WITH THE AKATO-TAGH IN THE BACKGROUND.



drainage-channel out of the Upper Astin-tagh, (which we crossed over on the 8th July 1900) yet so slight a swelling that it is not perceptible to the unaided eye. From the last-mentioned route we were able to see as far as the Kala-köl without let or hindrance.

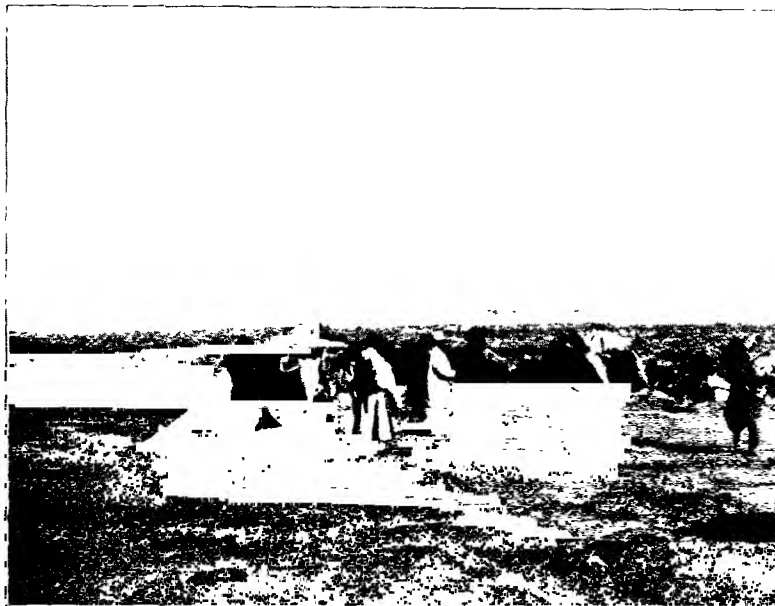


Fig. 194. THE SAME.

December 3rd. From Mandarlik we travelled towards the east-south-east, keeping a few kilometers from the foot of the mountains, in front of which stand occasional groups of small detached eminences. In the other direction, that is northwards, it was a long way to the southern foot of the Upper Astin-tagh, and in that direction there were only one or two very small hills, rising like islands above the otherwise level expanse. We passed the Kala-köl on our left, at a distance of 3 or 4 km. It appeared to be of oblong shape, and was then frozen over, notwithstanding the heavy percentage of salt it is said to contain, and all round its flat shores, there were even then white stretches of crystallised salt. On its southern shore, where the stream enters it, there was some grass. Here also was a very shallow temporary stream, divided into several arms which passed round a small free-standing rocky hill.

After that we forded a large eroded stream, called Külük-saj, a very important feature in the geographical morphology of the region. Its glen appeared to come from the S. 60° W. and to form a vast dividing-ravine between the Akato-tagh and the Schia-manglaj; the latter had continued to decrease in altitude right down to the left bank of the Külük-saj. Thus the Schia-manglaj is pretty sharply demarcated from the Akato-tagh, being a northern outgrowth from it, but it is much more intimately conjoined with the Ilve-tschimen. Orographically, however, the three names merely indicate different parts of one and the same range, sometimes lofty, sometimes low. After emerging from the mountains, the Külük-saj does not run particularly far towards the north-east before it terminates in a *lajdang*, or perfectly

flat surface covered with yellow clay deposited by its stream. Thus this last appears to reach neither the Kala-köl nor the Usun-schor.

As the teresken scrub thinned away, so did the balghun bushes begin to appear, and very soon they grew both higher and thicker; some of them even resembled small trees, though others were withered. Generally each had an accumulation of sand on its leeward side, and very often they stood upon low mounds. After that appeared the fairly extensive kamisch field that grows on the west shore of the Usun-schor. We next turned to the south and approached closer to the foot of the mountains, passing on our left hand the ice-sheet of the first freshwater spring embedded amongst the kamisch, and on the right the first offshoot from the range; there was barely room between the two for the path. Then we turned to the north-east, having on our left a succession of frozen pools and on our right the mountains. The latter send out several short spurs towards the north-west, with dry, steep glens and ravines between them; of the former we crossed over four by means of quite low passes. All along the foot of the range a series of springs gush out, and send down rivulets to the Usun-schor. The first of these springs, Abdulla-ustane-kajnasi, yielded perfectly fresh water, but the nearer we approached to the lake side, the saltier the water grew, until finally it was so salt that the open pools were no longer frozen. We pitched Camp XCV (alt., 2941 m.) in the outlet of a glen issuing between two small rocky spurs, severely weathered, with an extensive field of thick kamisch stretching away to the north. This then is the lowest and deepest part in the south side of the great *kajir* valley, namely close in under the foot of the southern range (fig. 195); although one would rather have expected to find the depression on the north side of the valley, or at any rate in the middle, for on the whole the surface rises towards the south, that is towards the Tibetan highlands. The portion of the Akato-tagh which towered up to the east-north-east of us was an imposing domeshaped rounded mass, without a trace of either peak or gap on its summit. It was quite evident, that here also it was built up of the same soft materials as we subsequently found it to be a long way farther east. We also observed, that its flanks were scored by an endless number of deep, narrow, steeply pitched gorges, down which even the uncurbed torrents had difficulty in making their way.

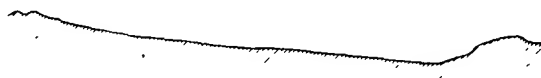


Fig. 195.

The little free-standing rocky height of Ak-modur consists of marble, partly pink, partly white as sugar, with an especially beautiful, fresh, and sparkling cleavage, and dipping  $39^\circ$  towards the N.  $5^\circ$  W. The first rocky promontory beside the Usun-schor was composed of a fine, close-grained, dark-coloured rock, lying  $89^\circ$  S. The first of the offshoots that we crossed over consisted of a dark tabular schist, so excessively weathered that it crumbled to powder at the least touch; it dipped  $50^\circ$  towards the N.  $80^\circ$  W. Not far from Camp XCV was a brittle grey granite, also severely weathered, and dipping  $30^\circ$  towards the N.  $20^\circ$  W. Farther on we passed during the course of the march detached blocks of granite. Indeed on the right bank of the

Mandarlik-saj, as also on the right side of a smaller saj immediately west of the Külük-saj, the blocks of granite are of pretty considerable size and have fairly rounded contours; the largest probably reach a cubical capacity of 6 to 7 cub. m. In Mandarlik especially they are heaped up in fairly large quantities in a strip parallel to the saj. They are composed of striped granite or gneiss, and are unquestionably erratic blocks. At all events it would appear that they are so at Mandarlik, when we recollect the nature of the whole of the mountainous region above them. At the extreme upper end of the valley are the two above-mentioned vast swellings of the Schia-manglaj, and proceeding from them and coming down between them it is evident that there was formerly a glacier. The great mountain-mass is covered with perpetual snow, and possibly also with ice, if one may at least draw any inference from the numerous intensely glittering patches and bands we saw upon it. These snow-fields and ice-expanses are the last surviving remains of the former glacier, which discharged the recently mentioned erratic blocks. It is of course wind and weather which have subsequently polished and rounded them. It is however one of the characteristic features of this region, that erratic blocks are extraordinarily rare; indeed it is such an uncommon thing to find blocks or fragments of stone lying scattered over the ground at all that the horses actually shied at them when they saw them. But we discovered no traces of moraines below the Mandarlik-saj; probably it is such an immense time since the glacier disappeared, that any former moraines there may have been have had time to become destroyed.

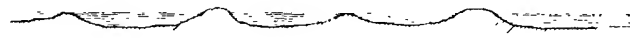


Fig. 106. RIDGES IN THE USUN-SCHOR.

December 4th. We continued along the southern shore of the lake, travelling east-north-east, crossing over only two small offshoots of the mountains by very low passes, though we passed a host of similar spurs on our right. All the way the lake hugged closely the foot of the mountains: often there was barely room for the path, which ran across schor. This is said to become in summer soft and *pattik*, that is such as a man sinks into, and the path is then impracticable. At such times the hunters use another path higher up, though it is difficult owing to the fact that it crosses over a great number of low passes.

The Usun-schor lies at an altitude of 2940 m. It is excessively shallow and its bottom consists, right away to the shore-line, of a deposit of salt some centimeters thick; it was cracked into reticulated or polygonal patterns, and up through the cracks the underlying mud projected in the shape of thin ridges or flanges. The tops of these little ridges were on a level with the surface of the water or rather a little above it. Fifty meters out from the shore there were none of these formations, but the water was clear and pure. I dare say they are existent there, only the depth of water is greater. In some places the shore-line recedes, making room between it and the foot of the mountains for a strip of marshy ground, so heavily impregnated with salt that it had not frozen and consequently was not hard, but gave way treacherously under our footsteps. In this part of the lake proper

the water was open, although its temperature was down as low as  $-7.9^{\circ}$ . It was only along the western shore, in which direction the belt of vegetation gradually thinned out until it came to an end altogether, that there was a fringe of ice barely 100 m. wide, the eastern edge of which was thin and ragged. In the west the lake is naturally far less salt, for it is into that part that all the freshwater springs discharge. Wild-duck and wild-geese are said never to stay beside this lake, because of the absence of the vegetation that they love to feed upon.

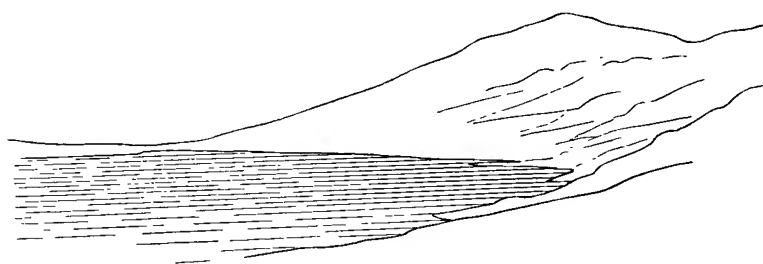


Fig. 107. VIEW OF A BAY OF USUN-SCHOR.

With regard to the shape of the lake, we obtained no clear conception of it; but the southern shore, which we followed, is said to be the longest, and this is probably true, for the deepest part of the valley lies just under the foot of the mountains. The long axis of the lake would thus seem to run from east to west, but from its western end a not inconsiderable bay appears to project towards the north. Travelling is said to be impossible along the northern shore owing to the ground being marshy and refusing to bear. The only way to get round the lake on that side is to keep a good way out from it. According to the statements of my guides, the lake maintains the same dimensions winter and summer alike, and this is probably true, for it is fed almost entirely by perpetual springs. All the same it is pretty certainly augmented temporarily after rain on the neighbouring mountains.

After crossing over yet another small peninsular spur, that juts out into the lake from the mountains, we became aware, at a couple of hundred meters from the shore, of a small rocky islet, or rather peninsula, for although it is completely separated from the other ridges, it is nevertheless connected with land, that is to say soft mud, on the north, and is said to be always connected with it in the same way. After that the lake contracts towards the north-east to a long, narrow marshy bay. The shore scenery which gradually unfolded itself as we advanced was altogether unusual and picturesque. On the left we had the smooth expanse of the lake devoid of vegetation, and on the right the fantastically shaped mountain headlands leaping forwards *en échelon* one behind the other, while in front of us towered the massive dome of the Akato-tagh, seamed with its thousands upon thousands of ravines.

In the extreme east of the lake, where the salinity is presumably greatest, the areometer remained with nearly half its length projecting above the surface of the water; the sp. gr. amounted to 1.21. Still it may not always be as much; for in the glen that we entered after leaving the eastern end of the lake, we per-



THE USUN-SCHOR, LOOKING WEST.



*Ljustr A. B. Lagrains & Westphal.*

USUN-SCHOR. LOOKING EAST FROM A POINT EAST OF CAMP XCV.





ceived distinct traces of a *sil-su*, or »sudden torrent», having poured down to the lake after rain, and this would of course render the water locally fresher. The natives assert, that the Külük-saj does not get down to the lake. But this is doubtful; at all events the Usun-schor is to be regarded as the terminal lake in the basin of the Külük-saj. Hence there exists a very striking homology between the Mandarlik-saj and the Kala-köl on the one hand and between the Külük-saj and the Usun-schor on the other.

After passing, though at a great distance to the north-north-east, a mountain spur, behind which lay the little spring and pool that we saw on the 8th July 1900, as also to the north-east the mountainous parts of the Akato-tagh which we traversed at the same time, we proceeded in a south-east direction, ascending towards a point where another glen, coming from the south-west, unites with our glen. This side-glen is said to lead up to the regions around the Ghopur-alik. From the point of junction it will therefore run east-north-east, and consequently continues in practically a straight line with the side-glen, that is to say parallel with the bedding of the schists. From the south comes yet another side-glen, which starts from an easy pass giving access to Bagh-tokaj. This is the route that is formerly said to have been chosen by the Mongol pilgrims who came from the north and were on their way to Tibet. Up to that point our glen was rather narrow and inclosed between steep cliffs, but beyond it the country became more open and the surface-features more rounded. Shortly after that we reached a flat, comfortable pass (alt., 3154 m.), without a name, and then went down the gentle slope on its eastern face, having low mountain-spurs on both sides of us, though at a great distance. From the pass our direction was east-south-east, and the surface was virtually level, soft soil, with a thin sprinkling of schistose gravel on the top; it was thickly marked with the footprints of kulans. After crossing over our former route, namely that which we followed down to the Tschimen-köl, we reached a rather deeply incised rainwater channel, containing a large quantity of drift-sand. It runs towards the south-east, and so enters the Tschimen valley. With the southern spurs of the Akato-tagh coming close down to us on the left, we continued towards the east-south-east, and thus gradually drew away from the mountains. The surface consisted of barren detritus, furrowed by shallow watercourses running towards the south-east. When we at length reached the belt of vegetation and the kamisch, the surface seemed to be perfectly level. However it soon turned soft and moist, lumpy and full of holes, with any quantity of small dry round pits, containing salt and surrounded by tiny ramparts of earth. We made Camp XCVI by the side of a freshwater brook, or rather beside a long sheet of ice, which was derived originally from springs and stretched towards the north-east. This is the extreme upper part of the Kurghan-saj (alt., 3002 m.), which goes on past Tasch-uj to Temirlik. On its way it picks up several spring-fed rivulets, and so gradually increases in size. Here we obtained access to water and grazing, but found no fuel.

On the shore of the Usun-schor, just east of Camp XCV, we had schist and conglomerate alternating, both severely weathered: the dip was  $36^{\circ}$  towards the S.  $35^{\circ}$  W. Opposite to the little rocky island in the lake, we had, at  $77^{\circ}$  S., a hard black crystalline schist alternating with a black argillaceous schist, laminated as thin

as paper and crumbling readily. A little farther on beside the lake we again came across a black finely crystalline schist, greatly folded, so that it cropped out at every conceivable angle. At the point of junction with the glen of Ghopur-alik there was an excessively hard, dark-coloured, fine-grained variety of rock, possibly diabase, lying at  $71^{\circ}$  N. On the pass the black schist stood vertically upright, its strike being N.  $70^{\circ}$  E. to S.  $70^{\circ}$  W. Generally indeed the rocks in this locality have a vertical pitch, or are at any rate very steep. To this fact it is in no slight degree attributable, that the mountains here have assumed such fantastic and ragged forms, and that they are seamed with such an endless number of gorges, ravines, and steep glens — all of which renders them so difficult of access. Every main glen is joined by hundreds of smaller ones, which lie close together and are separated by high, narrow mountain ribs. From that part of the Akato-tagh which abuts upon the Usun-schor, a great number of small spurs jut out, as we have seen, into the lake, and the glens that come down between them are deeply excavated, short, and very steep, and they terminate at the lake itself; though occasionally we came across a broad glen mouth or expansion, joined at its upper extremity by a number of similar smaller glens.

During these days the atmosphere was very unsettled. On 3rd December a storm raged all the afternoon except for one short pause. During the night snow fell, leaving a thin sheet on the mountains, though it disappeared almost entirely on the saline shores of the Usun-schor. On the 4th December again there was a storm from the west, and on the pass it waxed to a perfect hurricane, driving the particles of fine, dry snow before it along the ground. Thus in the extreme northern parts of Tibet the wind relations are entirely different from what they are in the adjacent lowlands to the north. In the latter quarter the relatively peaceful season of the year is the winter, but up in the mountains the winter is characterised by gales and storms from the west, which set in with almost the uniform regularity of trade-winds.

On the 5th December we traversed the remaining portion of our journey, crossing level ground towards Temirlik in the south-east. But here, in consequence of the countless number of round salt-pits, travelling was excessively irksome, and we were only able to advance by riding zigzag in every direction along the ridges between them. The track led also between a countless number of more or less extensive ice-sheets, the water of which issued from springs. After that we crossed over the spring-fed brook of Kasch-malghun, and after that over the Sasik-jar, the Tschong-jar, and the Kulak-jar, which we had already crossed over somewhat higher up, in July. At last however we once more reached Temirlik, our point of departure. The excursion covered 450 km., and took us over six passes of the first magnitude: but it did a great deal towards clearing up the physical geography, especially the orography, of the country. We shall return to the subject again in our general summary in vol. IV.

This will be a convenient place to insert certain information that I received orally from my guides with regard to the region around Paschalik and the Ilvetshimen. Even with the best will in the world it is quite impossible to peep into every glen and cross over every mountain-range that one perceives on either side of one's route. If one's map is to be at all complete, one must perforce have re-

course to the method of interpolation; and even though the information that the natives give may not always be usable, still it is information that is by no means to be despised.

For instance, I was told, that the Paschalik-saj joins the valley of the Ilve-tschimen about half a day's journey, or at the most at one day's journey, from Camps XCII and XCIII. Thus their two streams, which in the vicinity of these two camps run quite close together, approach one another at an acute angle, being separated by a low spur which juts out like a wedge, the same that we crossed over by the little pass just above Camp XCII. After the confluence the river turns to the west, or perhaps to the west-south-west, and has then, at first, on its left bank the ramifications of the range which rises on the left of Paschalik, and which is indeed an offshoot or branch of the Ilve-tschimen, while on its right is the Astin-tagh. The tract in which the river bends to the west is called Davan-teve; from it a path leads to Mian (Muran), a place belonging to the neighbourhood of Kara-koschun in the lowlands. From Davan-teve the track runs to the pass of Tasch-ato (or Tasch-ajtu = Tasch-davan or the Stony Pass). At Tamtschi on its western side there is a waterfall, which flings itself over a precipitous cliff. Then comes Säjpu-bulak, and thence one climbs up to the pass of Kil-davan, which is said to be situated in the main range of the Astin-tagh. North of this we have the region of Avras, and finally Tar-aghis, where the Mian brook issues from the mountains. From that point a track runs directly west-south-west across barren saj to Tscharklik, gradually deviating from the mountains. Even this brief oral information is sufficient to show that here also, as along the route from Tatlik-bulak to Basch-jol, the Astin-tagh is a double range, and consists really of two parallel chains. Lower down we shall find that this is also true of the range farther east all the way to Anambaruin-ula. But whilst the northern parallel chain is broken at Basch-kurghan and Tatlik-bulak, in travelling from Davan-teve one has to cross over both chains, for the breaches in them are situated west of the route in question.

It was by this route that Bonvalot and Prince Henry of Orleans travelled from Tscharklik to the Usun-schor, the same glen through the black schists that I followed when I proceeded farther up the side-glen leading to Bagh-tokaj — the route which I was told the Mongol pilgrims formerly used to travel by. Bonvalot's map also shows quite plainly, that the Astin-tagh is here double, although the mountains are not arranged in any sort of order, as I have pointed out in a previous chapter. To the Mian brook, or the lower part of the Paschalik-saj, which he forded below Tar-aghis, he gives the name of Djahan-say (Dschahan-saj). Then he proceeded up the Tchoukour-say (Tschukur-saj or the Deep Glen), which leads to Boulak-bachi (Bulak-baschi) and Kum-davan, which must be identical with Kil-davan. From it he went down to Bilaylik-say (Bilaulik-saj or the Grindstone Glen), a district clearly lying between the two chains of the Astin-tagh. Finally he crossed over the Tach-davane (Tasch-davan, probably quite as usual as Tasch-ato or even more familiar) to Davane-tay, which is identical with the above mentioned Davan-teve. Some of the other names on his map are easily recognisable, e. g. Pachalik, Guilvet Chimani (Ilve-tschimen), Mandalik (Mandarlik), and Chiamang-lay (Schia-mang-laj), although his unfamiliarity with the language has led him to distort them more or

less. I was not given the names Kara-kocho and Boulak-bachi between Paschalik and Mandarlik, but they may quite well exist for all that. I have already expressed my opinion upon Bonvalot's conception of the Chiman Tagh (Tschimen-tagh).

With his representations those of the map of the Russian General Staff agree on the whole. The latter writes Muran instead of Mian, and it is not unlikely that Mian is indeed a Turkish corruption of the Mongol word »muran», which signifies »a river». In between the transverse glens of Dschahan-saj and Tschukur-saj the Russian map enters Ur. Saj, that is to say the district of Saj — evidently under the impression that »saj» is the name of a certain district; whereas its true meaning always is the hard, flat talus slope at the foot of a mountain-range, though it also means »an eroded watercourse». Further we have the names of Avras-bulak, which is identical with my Avras and with Bonvalot's Bulak-baschi; Kum-boën (= Kum- or Kil-davan), Sejfi-bulak (= Säjpu-bulak), Tasch-davan, and Tasch-kul-baschi. The place at which the Paschalik and Ilve-tschimen unite is here called Ur. Kosch-lasch or the »district» of Koschlasch, a word that signifies quite simply »confluence», but is not used as a synonym for »district». Thus an examination of the names on the Russian map reveals the existence of two mountain-chains; but if we study the morphological designations of the region on the same map we search in vain for more than one chain, namely that in which Tasch-davan is situated. Carey and Dalgleish also travelled by this same route, and accordingly on their map we again have the names Tschukur-saj, Bulak-baschi, Kum-davan, Tasch-davan, Tasch-kul-baschi, Paschalik, Kara-tschoka, and Mandarlik. All the way from Tscharklik to Amban-aschkan-davan Bonvalot thus followed faithfully in Carey's footsteps, which can only be described as a waste of energy, for an opportunity was plainly lost of contributing to a wider and more comprehensive knowledge of the country.

The stream of Mian, which debouches upon the lowlands at Tar-aghis, is formed of the four following glens and spring-fed brooks — Ilve-tschimen, Paschalik-saj, Tughuluk, and Kum-taschlik. Of these the Paschalik would appear to be the longest, to possess the most energetically excavated glen, and in summer to carry the biggest volume. The Ilve-tschimen, which is formed, as we have seen, of two spring-fed brooks from the Schia-manglaj, is so far forth the most important stream in that it possesses an active current all the year round, for it is fed by spring-water contributories both above and below our Camp XCIII. If we consider the Ilve-tschimen to be the main artery and principal stream, then the three others are its affluents and flow parallel to one another from south to north. And it is quite natural that the hydrographical arrangement should be thus, that is to say, that all three affluents should enter the main stream from the left. For, while the mountains on the north, the Astin-tagh, have a very short slope towards the river's valley, and arrest but little rainfall on that side, the slopes of the opposite mountains, the Ilve-tschimen, are very long and deeply scored with rainwater channels, and receive an abundance of rain. This arrangement is characteristic of northern Tibet and of the rivers which flow down from it to the basin of the Tarim. We shall find the same thing occurring in the nearest neighbour of this stream towards the west, namely the Tscharklik-su, and it is also conspicuous on a larger scale in the case of the Tschertschen-darja, the Kerija-darja, the Khotan-darja, and even the



THE LOESS TERRACE WITH THE GROTTOES AT TEMIRLIK.



*Lustr. A. B. Lagrelius & Westphal*

THE GREAT ICE-SHEETS FORMED BY SPRINGS AT TEMIRLIK.



Jarkent-darja. With regard to our little stream of the Ilve-tschimen, that part of its course which has an east-west direction flows close under the crest of the Astin-tagh, but a pretty long way from the crest of the Ilve-tschimen. The great spurs between which the three affluents have scooped out their beds all branch off from this latter range. The Paschalik-saj we have already dealt with. Next comes the Tughuluk, which enters the main stream at the point where it makes a slight bend towards the south. It is formed by two spring-water feeders, the eastern one issuing from the same mountain complex as the Buktöj, which, as we have seen, flows towards the east and enters the Paschalik, while the western feeder originates in the same mountainous region as the Kum-taschlik stream. I have mentioned above a track which is said to lead from Buktöj *vià* Tughuluk and Kum-taschlik to Tscharklik; this is joined by other tracks from Ottoru-buktöj and Astin-buktöj. But where these tracks lead to I have been unable to ascertain, that is whether they descend one or other of the transverse glens or whether they cross transversely the various offshoots that separate those glens.

The Tughuluk-saj is joined from the right by two tributaries, the Jajlak-saj and the Schor-tschap. The Kum-taschlik receives from the right the glen of Atschik-su. The fact of these tributaries coming from the right does not necessarily prove that the main crests of the several mountain spurs lie excentrically or transposed to the east; for not only have we found that the Paschalik receives from the left the three side-glens of the Upper, Middle, and Lower Buktöj, but it may be a pure chance that it is only the glens on the right that are named.

When all these sajs carry water, as they do in the summer — we have been told that the Paschalik alone is so large that it is not easily fordable — they combine to form a stream which often brings down formidable quantities of water. According to the description that was given to me, the above-mentioned Tasch-davan route quits the glen of the stream on the left, or west, beginning at Davan-teve, for just there the glen becomes absolutely impassable. From that point therefore it may be regarded as a deep, wild mountain gorge, its bottom littered with stones and gravel, the entire bed of which is in summer filled with a rushing, foaming torrent, fenced in on both sides by perpendicular walls of rock. The nearest point at which this gorge can be passed is precisely Tasch-davan. The place where the stream issues from the mountains is known as Tar-aghis, or the Narrow Opening» (properly «mouth»), and it does so through a narrow rocky gateway, the termination of the deep, wild gorge. It put me in mind of the similar rocky portals that I visited in the Kirk-saj between the Tschertschen-darja and the Kerija-darja. According to what my guides told me, it is indeed possible to proceed a short distance up the gorge, as far as a couple of expansions, where bushes and underwoods grow, but above that the glen is absolutely impassable; just as we shall find the Tscharklik-su to be where it issues from the mountains. Even in winter the narrow gorge between Tar-aghis and Davan-teve is not used: the natives prefer at all times the track *vià* Kum-(Kil)-davan and Tasch-davan. Such a thing as anyone even attempting to force the gorge had never been heard of, and it is probable that in winter it is not practicable for horses, perhaps not even for pedestrians.

The water which issues out of the Tar-aghis, and flows farther north for some 30 to 40 km. from the foot of the mountains, gives origin to the oasis of Mian and irrigates it. There a number of Lopliks, especially from the Abdal region, grow cereals, and vegetation is said to be abundant, and there is even forest. There can be no doubt that formerly a certain measure of importance attached to this point, for there are said to be ruins of houses, a *kona-schahr* in fact. As a rule the stream stops just below Mian, though in the months of April, May, and June it is said sometimes to get down as far as the marginal lakes between Abdal and Kumtschapghan. But before doing so it gives rise to extensive flat alluvial deposits, *kakir*. At Tar-aghis the water is said to be perfectly clear, but 6 or 7 km. above Mian it is *lajlik*, i. e. impregnated with mud and clay, for it there enters a *jul-ghunlik-jer*, or country plentifully studded with tamarisks. Owing to the numerous springs which are reported to exist just below where we made Camp XCIII, the water is said to flow out of Tar-aghis all the winter, but it barely reaches half-way to Mian when its flow ceases and it spreads out, forming immense sheets of ice. Two or three of the natives asserted that the Ilve-tschimen is under all circumstances, even in summer, bigger than its three tributaries, and of these that the Paschalik exceeds considerably its two westerly neighbours. In the year that I visited these regions, namely in 1900, the great river from Tar-aghis reached as far down as Mian in the end of April, though previous to that it formed only an insignificant rivulet. From Mian it proceeded to the Abdal lakes, where it discharged for the space of a month, being very muddy and of a red colour. Subsequently its volume decreased at a pretty rapid rate. Mian is not inhabited during the winter; the antelope hunters, who visit the region at that season, are always able to get access to spring-water. But in the spring, when the water is expected from Tar-aghis, a man is sent up every day to see if it is coming, and when he reports that the water is coming, the agriculturists betake themselves there, with their *ketmen*, or 'spades', for the purpose of sowing wheat and other cereals, which five months later are ripe for the harvest. They also cultivate vegetables and melons. I was told too, that for a good distance below Tar-aghis the bed of the river is full of stones and gravel, that is before it emerges upon the hard, gently sloping *saj*. At Mian there is a belt of toghraks, stretching 5 to 6 km. down-stream; these are followed by a belt of tamarisks growing on high mounds; and finally there come *kakir* desert and *schor*. Thin scrub accompanies the river all the way down, though only quite close to the river-bed.

With regard to the distances in the region in question, it is reckoned a day's journey from Camp XCIII to Davan-teve; from Davan-teve to the end of the Tughuluk is half a day, thence to Kum-taschlik half a day, and from there to Tar-aghis the distance is estimated at two days' journey. From Davan-teve *via* Avras to Tar-aghis is reckoned to be three days' journey, and from Tar-aghis to Mian is one day's journey.

It is probable that yet another side-glen could be found joining the main glen west of Kum-taschlik, though none such was indeed known to my guides. From the same mountain-mass that gives birth to the western feeder of the Tughuluk, and in which the Kum-taschlik has its beginning, the river Haschäklik also proceeds.



This, which is one of the feeders of the Tscharklik-su, we shall become better acquainted with in the sequel. The map of the Russian General Staff of this district is very incorrect, neither its hydrography nor its orography corresponding to the reality. It makes the Haschäklik enter the Dschahan-saj, and flow eastwards, instead of flowing west, as it actually does. Its Atlasch-su no doubt corresponds to one of the two western tributaries. And equally imaginary is its delineation of the mountains from which these rivers flow. For instance, it shows two mountain-ranges quite close together, and calls the more southerly one the Tschimen-tagh and the northerly one the Jusup-alik-tagh, and then makes them both unite in a mountain-knot which in respect of position answers to the Schia-manglaj. But as it happens, there is just there only one mountain-range, namely the Ilve-tschimen, which we crossed over at Ghopur-alik. On the other hand the glens of Mandarlik and Külük-saj are entered pretty correctly. Although the Akato-tagh (Ak-ajtu-tagh or the Range of the White Pass) and the Ilve-tschimen are one and the same range, running continuously east and west, they may nevertheless be practically distinguished, the dividing-line being drawn at the low and easy pass which we twice crossed over, in an exceptionally deep gap in the range. From that dividing-line the Akato stretches eastwards all the way to Tsajdam, where it melts away and comes to an end. The Ilve-tschimen extends from the same gap westwards to the districts in which the head-feeders of the Tscharklik-su originate. We shall cross both these ranges again by new passes, and after that I will seize the opportunity to discuss the mean altitude of their passes in general. Between the Ghopur-alik, Camp XCIII, the Paschalik-saj, and the Usun-schor rises the immense mountain-mass of the Schia-manglaj, which appears to form a stupendous compact swelling; it is at the same time a northern spur of the Ilve-tschimen range.

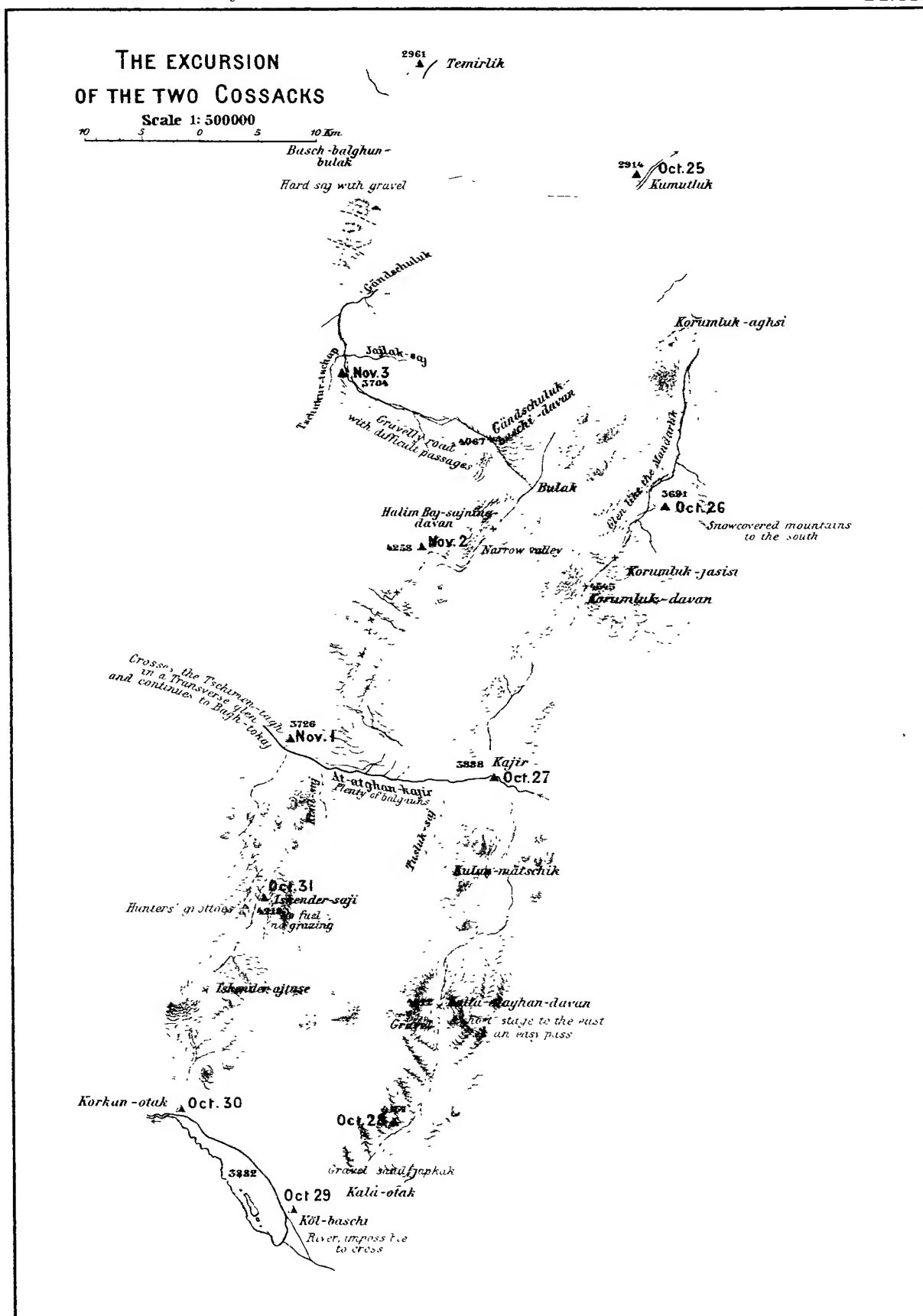
The little range, already mentioned, which is situated immediately south of the twin lakes of Schor-köl, and which we left on the north of our route, is said to form a south-eastern spur of the southern Astin-tagh, and as such it is shown on the Russian map.

From the crest of the lower Astin-tagh several transverse glens run down towards the north, in the direction of the marsh of Kara-koschun. Beginning at Mian-Dschahan-saj, and proceeding east, we find their names are — Avras-saj, which appears to begin in the vicinity of Kum-davan and at Jakube-bulaghi effects a junction with its nearest neighbour on the east, the Julghunluk-saj; Kövna(=Kona)-bulak and Jajlik-saj, which join at Pakta-bulak, a spring reported to be situated midway between Mian and Dungluk-kuduk (where we rested on 1st June 1900); Asghanlik, which is said to terminate just above Dungluk-kuduk; Julghunluk-saj; Dschan-bulak, which is reported to end half a day's journey east of Dungluk-kuduk; Toghrak-tschap and Kosch-bulak, which after emerging from the mountains unite and form an eroded watercourse; Kurghane-haltasi, past the end of which we marched on 2nd June; and finally Tatlik-bulak, which I have already discussed. It is only after rain has fallen up in the mountains that these transverse glens sometimes carry water; they are all said to be fed by springs, and this will certainly be true, at all events, of those that terminate in the suffix »bulak». But even after rain their waters never advance farther than to the belt of vegetation to which the common

name of Dungaluk is given, and to which both Mian and Dungaluk-kuduk belong. Of the names which I have enumerated the Russian map gives Asghanlik, Dschan-bulak, Kosch-bulak, and Tatlik-bulak. In my list one name is missing, namely Tschukur-saj, which occurs in both Carey and Bonvalot; probably this is identical with the Avras-saj. Between Dschahan-saj and the Tscharklik-su my men knew of only one transverse glen, namely Toghrak-tschap, and it lies, they told me, midway between the two glens mentioned.

A path leads from the twin lakes of Schor-köl to the pass in the Astin-tagh, from the north side of which the Asghanlik glen starts, while another path leads to the head of the Jajlik-saj. From the summit of the main range down to the Dungaluk belt of vegetation is reckoned three days' journey, though they must be short days. From the Usun-schor a path leads to the *baschi* or head of the Dschan-bulak in the main range of the Astin-tagh.

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## CHAPTER XVI.

### EXCURSION OF THE TWO COSSACKS.

Before proceeding to describe my winter journey through the Astin-tagh to Anambaruin-ula, I will here interpolate certain information gleaned by the two Buriat Cossacks, Schagdur and Tscherdon, during the course of a reconnaissance which they made between the 25th October and the 4th November. After I had given the former of these two men, who was remarkably intelligent, and able both to read and to write, a thorough lesson in surveying, I sent him off to make a map, however hurried, of a region which I had neither time nor opportunity to visit myself. The object was to give me an approximate idea of those parts of the Tschimen-tagh and the Kalta-alaghan which lie between the route that I followed from Mandarlik to Avras (this must not be confounded with the same name which we encountered in my last excursion) on the east and the route from Temirlik to the Kumköl on the west. The two Cossacks proved themselves fully worthy of my confidence: the observations they brought back with them were such as I have been able to use. All the same I must of course communicate them with a certain amount of reservation, for I have not seen the region in question with my own eyes.

Accompanied by three hunters who were well acquainted with the region, they set out from our headquarters camp at Temirlik on the 25th October, and rode south as far as Basch-balghun-bulak, and then east as far as the eroded watercourse of Komutluk, which I crossed over on the 12th July. Here they made their first halt. Thus far their route was said not to be identical with mine, but to run a little to the north of it.

On 26th October they first marched 27 km. towards the south-south-east, crossing the Tschimen valley diagonally to Korumluk-aghsi, or the lower end of the transverse glen of Korumluk, on the northern side (alt. 3157 m.) of the Tschimen-tagh. Some kilometers from the foot of the mountains they crossed over an eroded watercourse running towards the N. 60° E., plainly making for the Ghas-köl. Between this watercourse and the spur on the left side of the glen-mouth stretches a tract of minor drift-sand dunes, exactly in the same way as we have found they do in the regions farther west. The eroded watercourse which comes down at Korumluk-aghsi is at first directed towards the N. 10° E., but gradually inclines more and more towards the north-east: after rain in the Tschimen-tagh the stream gets

down as far as Boghan-otak, though at other times it stops short higher up in *kakir* ground. From the outlet of the glen up to Camp No. 2, at an altitude of 3691 m., the surface rises almost due south, the glen winding however a little at times. On both sides it is shut in by rocky arms of the main range. This second camp was situated in an expansion, stated to be as broad as the glen was at our headquarters at Mandarlik. Just above the camp the glen was joined at approximately the same point by a large side-glen from the right as well as by another from the left. To the south-east some great snowy peaks were visible.

On 27th October the men continued farther up the glen, travelling south-south-west to the main crest of the Tschimen-tagh, and so reached the pass of Korumluk-davan at a distance of 10 km. from camp. Halfway to the pass they crossed over a secondary col called Korumluku-jasisi (*jasisi* is stated to mean »level terraced grazing-ground surrounded by lofty mountains«). From that point the ascent to the main pass is quite perceptible, although regular, but the last portion, just under the pass, is steep. On the south side the declivity is however a good deal steeper, as well as thickly strewn with gravel and stones, and it is from this circumstance that the pass derives its name of Korumluk-davan, or the »Stony Pass«. Here the aneroids indicated an absolute altitude of 4545 m. The temperature of the air was  $-7^{\circ}$  at noon; the wind blew hard from the south-west and the sky was half covered with clouds.

Descending by the transverse glen on the southern side of the Tschimen-tagh, they travelled 25 km. towards the south-south-west, south-west, and south as far as the broad, open latitudinal valley between the Tschimen-tagh and the Kalta-alaghan, and made their third camp in the middle of the valley, on the left bank of its stream, at an altitude of 3888 m. As from this point they proceeded to ascend the Kalta-alaghan directly, we see that the Ara-tagh, which south of Mandarlik we found to be interpolated between the two ranges just mentioned, melts away above, that is to the east of, Camp No. 3; the two latitudinal valleys which we noted on both sides of the Ara-tagh having united to form one, the At-aghan, the glen in which Möle-kojghan is situated, though farther west than the camp of the Cossacks. This is the same glen that we ascertained to pierce the Tschimen-tagh above Kara-tschoka and Ghaslik. The Cossacks' guide called this great latitudinal valley simply Kajir, a word which locally is synonymous with »latitudinal valley«. At that point the glen comes down from the S.  $80^{\circ}$  E. and proceeds farther towards the N.  $70^{\circ}$  E. Not far below their camp the valley is joined by the transverse glen of Tusluk-saj, issuing from the main range of the Kalta-alaghan.

Just above the camp was the outlet of the transverse glen of Kulan-mätschit; this they followed on the 28th October, travelling south-east, south, south-west, and south, until they reached the summit of the Kalta-alaghan. The lower part of this glen is broad and open, and on the east is bounded by hills. To the south-west, though at a great distance, vast mountain-masses were visible, belonging to the main range of the Kalta-alaghan. About halfway up to the principal pass they crossed over two small secondary passes; to the south of them the glen grows narrower, being fenced in by lofty walls of rock. After marching 33 km. they at length reached the principal pass, which the guide called Kalta-alaghan-davan. Its

northern acclivity ascends fairly regularly, but the southern is steep and, like the similar declivity of the Korumluk-davan, choked with stones and detritus. This pass has the reputation of being difficult and awkward, and is used only by hunters. Its absolute altitude amounts to 4412 m. The temperature of the air was  $-7.4$  at 1 p. m., with a faint easterly breeze, and the sky was clouded to the extent of nine-tenths. There was said to be another pass less than half a day's journey farther east, namely the one that I saw to the south-west from the top of the Ara-tagh, though I did not cross by it.

A little way below the pass the descending transverse glen contracts to a deep-cut gorge between naked walls of rock; but below that it widens out again, and in the district where Camp No. 4 was pitched, 12 km. south-south-west below the pass, it is broad and open. Here the altitude was 4137 m.

On 29th October they travelled 16 km. to the south-west to Camp No. 5, which they formed 200 m. from the shore of the Upper Kum-köl, at the north-east corner of the lake, which the natives call Köl-baschi, or the Beginning of the Lake. The glen in which Camp No. 4 was situated opens out into the basin of the Kum-köl just below that camp, and its eroded watercourse became lost in the detritus and coarse sand of the talus, on which there was a sprinkling of japkak scrub. The name of this district, between the outlet of the glen and the north-east corner of the lake, is said to be Kala-otak, which agrees with Carey and Dalgleish's map: they call their camp, just east of the lake, Kalla-ottlak. I am unable to say which of these two forms is the more correct: Kalla-ottlak means the Grazing-place of the Cows, and Kala-otak, the Resting-place of the Cows or the Place where the Cows Rest. By »cows» are of course meant the cows of the wild-yak, which are perhaps wont to wean their calves in districts where there is better grazing. On the map of the Russian General Staff the Kum-köl-darja is incorrectly called Kalla-utagh; this seems to suggest that the form Kala-otak is the alone correct one.

With the view of obtaining a trustworthy check upon the Cossacks' map I instructed them to visit my Camp XVI of 27—29th July. With that object in view they were to ride round the east end of the lake till they came to the old camp, before proceeding along the north shore of the lake on their way back again. This should have brought them over the brook that is formed by the marsh, the springs, and the springfed pools of Bulak-baschi and enters the lake at its eastern end; but they found it absolutely impossible to ford the brook. The water was indeed shallow and clear, but the bed was so soft that the first horse that attempted to cross the stream was instantly swallowed up in the ooze, so that nothing but his head remained above it, and it was as much as they could do by uniting all their forces and using ropes to get him out again. Carey and Dalgleish were also forced to make a wide detour at this place in order to get past these marshy tracts, and even then they appear to have experienced considerable difficulty in fording the stream, for they encamped on both the east and the west side of the morass. In spite of the severe cold the brook was not frozen, even at its mouth; this must have been because of the constant high temperature of the spring-water.

From Camp No. 5 they were however able to see the site of our camp of 27—29th July: it lay to the S.  $30^{\circ}$  W., and the distance admitted of being calculated

approximately from the line of soundings which I took diagonally across the lake, this line being a short distance to the west of the compass-bearing which I have already mentioned.

On 30th October they followed the northern shore of the Upper Kum-köl, travelling towards the north-west. The lake gradually narrowed and after 15 km. came to an end, and the Kum-köl-darja appeared; there they formed Camp No. 6. That locality is called Korkan-otak, and it will be about 55 km. from it to the eastern end of the Ajagh-kum-köl. They found the whole of the western part of the Upper Kum-köl to be very shallow, and merging imperceptibly into the Kum-köl-darja, which alone was then covered with a thin sheet of ice. All along the northern shore the grass was not at all bad.

From Korkan-otak, which has an altitude of 3882 m., they returned towards the north-north-west, ascending a short, broad transverse glen in the Kalta-alaghan, and after going 18 km. reached the pass of Iskender-ajtus, which is a good deal lower and easier than the Kalta-alaghan-davan. The temperature of the air dropped at noon to  $-8.6^{\circ}$ , there was a fresh breeze from the south-east and the sky was perfectly clear. Prschevalskij, Carey, and Bonvalot all crossed the Kalta-alaghan by the same pass, namely the Amban-aschkan-davan. My excursions into Northern Tibet have resulted in an addition of five other passes being made to this one. From the pass the Cossacks continued 13 km. in the same direction down through the Iskender-saji (so called after a hunter from Tschertschen), and pitched their Camp No. 7 in an open locality known as Unkur (pronounced Unghuj), a name meaning "grotto", "hole", or "ravine". It is bestowed because of some earth-caves existing there, in which hunters are wont to spend their nights. Here there was neither grass nor fuel; nevertheless wild-yaks, kulans, and wild sheep were all especially numerous.

On 1st November the party continued towards the north-west and north, going down by a broad glen, shut in by not particularly imposing mountains. After travelling 20 km., they made Camp No. 8 on the right bank of the At-atghan-kajir, at an altitude of 3726 m., or 162 m. lower than their Camp No. 3 in the same valley; while Möle-kojghan, which lies farther west, has an altitude of 3594 m. The principal channel of At-atghan approached their new camp from the east and continued on towards the N.  $80^{\circ}$  W.

On 2nd November they travelled first 20 km. towards the north-east, proceeding up the At-atghan and then climbing up a transverse glen of the Tschimen-tagh until they reached a point where they found themselves going almost due east. Along this section of the journey, 15 km. in length, they crossed, in each case by an easy, rounded, secondary pass, four successive spurs of the main range of the Tschimen-tagh, having the main range all the time on their left hand. These spurs are parted by glens, not very deep, running towards the south-south-west, and all entering the glen of At-atghan. Camp No. 9 was made in the transverse glen of Halim Baj-saj-künäsi, that is to say the Southern Glen of Halim Baj.

On 3rd November they advanced  $3\frac{1}{2}$  km. farther east up the Southern Glen of Halim Baj, and then, still in the same glen, which was here narrow, almost 5 km. more towards the north-north-east to the Halim Baj-sajning-davani, one of the



principal passes in the Tschimen-tagh, with an absolute altitude of 4258 m. The temperature of the air was here, early in the forenoon, — 10°; there was a stiff gale from the south-east and one-fifth of the sky was clouded. On the other side of the pass they went down towards the north-north-east, following the northern transverse glen of Halim Baj for 5 km., this glen being bordered on its right, i. e. east, side by lofty black mountain-masses. It issues, as we have already seen, upon the main Tschimen valley and belongs to the basin of the Ghas-köl. But instead of continuing down this latter valley, they left it at a certain spring and struck up one of its left-hand side-glens towards the west-north-west, and after going 4 km. reached the secondary pass of Gändschuluk-baschi-davan, situated in a northern spur of the Tschimen-tagh that separates the glen of Gändschuluk from the glen of Halim Baj. This pass possesses an altitude of 4067 m. Thence they proceeded 22 km. to the north-north-west down the Gändschuluk-saj, the lower part of which is again choked with detritus and stones, so that there are several difficult passages. Just below camp No. 10 (alt. 3704 m.) there came down from the right, i. e. the south-east, the side-glen of Jajlak-saj and from the left, or south-west, the side-glen of Tschukur-tschap.

On 4th November, shortly after emerging from the glen of Gändschuluk, they again crossed diagonally over the Tschimen valley, marching north-north-west and north until they reached Temirlik. This stage made 47 km. The glen of Gändschuluk starts, I feel sure, from a main pass in the Tschimen-tagh, but it is probably difficult, seeing that the guide preferred to make a detour over the pass of Halim Baj. Outside the lower end of the Gändschuluk glen there is again a belt of drift-sand dunes, which, according to the Cossacks, seems to be broader than elsewhere. Although it is true that we only saw this belt of sand outside the mouths of the glens, it may nevertheless be taken for certain that it runs uninterruptedly all along the northern foot of the Tschimen-tagh.

The most important discoveries made during the course of this excursion were two new passes in the Tschimen-tagh, and two also in the Kalta-alaghan, together with the definite knowledge, that the Basch-kum-köl is only 15 km. long, and not 66 versts as the Russian map makes it out to be; there also it is erroneously called the Tschong-kum-köl. Finally this reconnaissance was also of value, in that it furnishes information as to the situation and configuration of the two mountain-ranges between two of my own routes across them.

During the course of the journey the Cossacks collected a number of geological specimens, which however are of insignificant value owing to the uncertainty as to the localities where they were severally taken. They prove however that both ranges are in these sections built up almost entirely of crystalline rocks, as they are both farther east and farther west. On the way out, that is going from north to south, they took successively light, fine-grained granite, gneiss or striped granite, a fine-grained grey schist, dark porphyry, red porphyry, and crystalline schist; while on the return journey, that is from south to north, they collected crystalline schist, black porphyry, a grey compact rock, mica-schist, dark fine-grained granite, red gneiss, argillaceous schist, crystalline schist, some of it very fine-grained, some of it coarser, and lastly porphyry again, and two or three varieties of granite.



# JOURNEY TO ANAMBARUIN-ULA



## CHAPTER XVII.

### THE GHAS-KÖL AND TO THE DOUBLE GORGE IN THE AKATO-TAGH.

From the 5th to the 11th December I remained at our headquarters camp at Temirlik, busily engaged in preparing for the great excursion which I proposed to make all through the Astin-tagh as far as Anambaruin-ula, then across the Deserts of Gobi and Lop, and along the Kuruk-tagh, and finally along the Kara-koschun to Tscharklik. The greater part of this journey has been already described in vol. II; it only remains now to describe that part of it which belongs to the Tibetan highlands.

During this my last week at Temirlik (the Sum-tun-buluk of the Mongols, bordered on the east by the Tschal or Gobi = Tschöl or Gobi) winter made a good step in advance and the temperature fell to  $-27^{\circ}$ . The nearest springs had at the point where they gushed out a temperature of  $4.5^{\circ}$ ; the ice-sheets they formed continued to increase fast, until finally they resembled small glacier tongues, putting me forcibly in mind of the »ice volcanoes» that I saw at Mus-kol on the Pamir in 1894.

I will now describe the journey in detail day by day, forming as it were a commentary on each successive sheet of the accompanying atlas.

Although our immediate goal was Ghas-köl, due east of Temirlik, we marched at first towards the north-west, so as to avoid a region of marsh and swamp, and thus once more crossed over Kulak-jar, Tschong-jar, and Sasik-jar, though a little lower down than where we crossed over them before. On the other side of Sasik-jar the kamisch steppe gradually thinned away and expanses of bare clay became more and more common. All three ravines were then perfectly dry, and in the shelter of their lower-lying watercourses the kamisch was growing thickly. At the point where we crossed over the Kulak-jar it was divided into two channels. In the next ravine, the deeply sunk Kasch-malghun, there was a little water, but except for that it was full of ice. In the summer it is said not to carry a greater quantity of water than it had then, unless after rain. Amongst the balghun bushes a little to the north there were pretty large and compact sheets of ice, formed partly by separate springs, partly by rivulets from the Kasch-malghun. The ice

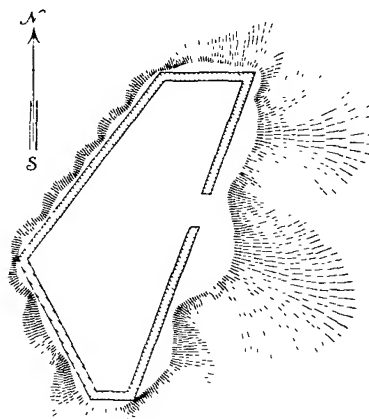
continued towards the north-east, but without joining the main watercourse. Immediately to the left of the ice we followed a broad, shallow watercourse, covered with detritus, then dry, though in the spring, when all these ice-sheets melt, it is reported to be traversed for some days by a pretty lively stream, which however soon runs into the Kurghan-ileghi. It is only after the thawing of the ice and after rain that this watercourse carries water; at all other times it is dry. On its left bank there are hills 4 to 5 m. high. In the Kurghan-ileghi, which we next crossed, a little water was flowing; it was not frozen because its springs were situated close at hand. In the summer it is said to carry a good deal of water; it was a little higher up on its bank that we had our Camp XCVI. The watercourses which we crossed over at first all ran towards the north-east; now they had a more easterly direction and gradually united before entering the Ghas-nor, where we shall presently have an opportunity to study their common embouchure. Shortly after passing the last watercourse we encamped in a district called Julghun-dung, named from some tamarisk-mounds. Here too there was a small rivulet trickling out of a spring, and beside it balghun bushes and kamisch were growing. This was therefore one of the well-known localities in which water, grass, and fuel can all be obtained.

December 13th. Our march was towards the N.  $70^{\circ}$  E. Immediately north of Julghun-dung rises a little hill, composed in part of hard rock. Its almost flat top is crowned by the ruins of a *tasch-uj* (i. e. Stone House), or »old fort», from which perhaps the name of Kurghan-ileghi is derived. The walls are constructed of stone, for the most part only  $1\frac{1}{2}$  m. high, seldom as much as 1 m. The ground-plan and dimensions are shown in the accompanying sketch (fig. 198). In the east wall there is a breach, a door, and on that side the hill is not so steep, though its western side is almost perpendicular. What object this little fort may have served it is difficult to say; its only *raison d'être* seems to be the little 5 m. high hill itself, which commands all the flat country around it. Perhaps it was once a Chinese *karaul-chanch*, or »watch-post». On two or three of the spurs on the southern shore of the Usun-schor we had seen small circular walls of barely 2 m. in diameter, built during the last Tungan revolt, with the object of protecting East Turkestan against invasion from the mountain regions. The fort we are now discussing, which is known simply as Tasch-uj, dates from a much older period. South of the hill there were two small springfed brooks, containing good water at a temperature of  $+2.5^{\circ}$ .

On the other side of the ruined hill-fort we passed several similar brooks, forming more or less extensive sheets of ice; the country was mostly bare except for a thin sprinkling of kamisch. After that came a belt of white schor, dotted with a number of small round salt lagoons, 1 to 4 m. in diameter, and surrounded each by a low, but distinct, circular rampart. The bottom of these pools was generally about  $\frac{1}{3}$  m. lower than the adjacent surface and was in many cases covered with a fairly thick layer of white salt. At this time they were dry, but in the summer the entire region is marshy and impassable. It is difficult to say to what cause these characteristic formations owe their existence; we already came across instances of them on 5th Dec. west of Temirlik. It can hardly be the numerous springwater brooks that produce this effect, especially as circular lagoons occur also in places where there are no brooks, equally as in the vicinity of brooks. It is

more probable that these depressions are caused by springs which gush up out of the ground, and that the salt collects in them after they are formed. At this time the salt marsh was frozen hard and bore everywhere, indeed the surface was often as hard as stone and the salt frozen clay (schor) crackled like burnt ballast under our horses' feet. This sort of surface is however very tiring to march on, especially for the tender-footed camels.

A little south of our route there were large sheets of ice. The schor soon came to an end and was succeeded by hard gravelly saj, excellent for marching on. On the right extended not only a belt of vegetation, but also white expanses of schor. We had gradually been approaching nearer to the southern foot of the Akato-tagh; already its *jilghas* and deeply trenched glens and ravines were beginning to show more and more distinctly, and even from a distance we gathered the impression that this peculiar mountain region would be difficult to cross over. Presently we came to Ak-atoning-saj, a number of shallow eroded watercourses, which issue from a large glen with a scree of considerable size that was visible to the N. 32° W. The stream which flows out this glen portal after rain



Scale 1 750

Fig. 198. PLAN OF TASCH-UJ.

spreads out, immediately north of our route, into the shallow deltaic arms which I have just mentioned. The bottom of these channels consisted for the most part of hard mud, though in places there were long strips of gravel. Gradually these watercourses assume a more easterly direction. Dry wood of the balghun bushes, which had been washed down from higher regions and got stuck fast in the mud, was plentiful, but live bushes, standing on mounds, grow also between the deltaic arms. The kamisch here also grows upon elongated elevations, with almost vertical sides, though seldom more than 1 m. high, running parallel with the various deltaic arms, and evidently eaten away at times by their torrents (fig. 201). They appeared to continue for some distance farther down, on the right of our route, and impart to the surface a «hummocky» appearance.

From that point we travelled east-south-east across scanty kamisch steppe, furrowed at intervals by occasional watercourses. We made Camp XCIX at Tschigelik-kasch (alt. 2899 m.), where there were several small sheets of ice formed by springs. North of these rise some low grey hills of clay. This camp was only a few kilometers distant from the Akato-tagh.

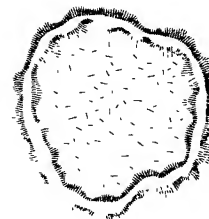


Fig. 199. LITTLE SALT DEPRESSION.

On 14th December we made an excursion to the Ghas-köl, situated 22 km. to the south-south-east of Tschigelik-kasch. The statements with regard to the salinity of this lake, which was discovered by Prschevalskij, differ greatly. Most of my men declared that it does not freeze at all; others asserted that it freezes when the winter is farther advanced. One of my men added, by way of confirmation of the latter statement, that in the preceding winter he had set a wolf-trap on the lake-shore in order to get wolf-

skins. A wolf got caught in the trap (*tosghak*) and dragged it after him on the ice across the lake at the part where it is broadest. At the part indicated the breadth was stated to be such that a man on the one side could just discern a yak or a horse on the opposite shore looking like a tiny black dot. Seeing then that the statements about the lake were so conflicting, I took with me my canvas-boat, intending to send it back to Temirlik when done with.

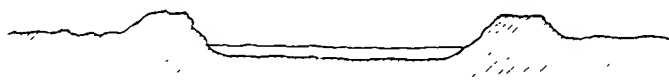


Fig. 200. VERTICAL SECTION OF THE SAME.

Not far from Tschigelik-kasch we passed some large sheets of glittering ice, formed by the brooks that we had crossed over the day before. On the left we had a stretch of clay hills, which however did not extend very far. After that the surface was again flat, its slope down towards the lake being quite imperceptible to the eye. It was however objectionable to march on, consisting as it did of lumpy schor, cracked and broken into holes and ridges, and furrowed at intervals by watercourses that wind away down towards the lake. Sometimes however riding was rendered easier by the kulan tracks, which crossed one another in every direction and grew increasingly more numerous the farther we advanced towards the south; and to our left we now saw large troops of kulans. It was astonishing that they should stay in such a barren country, where the scanty kamisch, which occurs in patches was eaten off level with the ground. Hares too were plentiful.

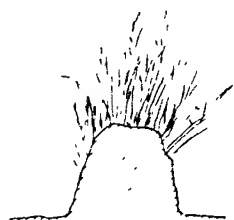


Fig. 201.

Next we traversed at right angles a strip of mounds, crowned by decaying or already dead tamarisks. This strip of vegetation is now situated in the middle of the salt desert that surrounds the lake, and no doubt the lake was formerly bigger and reached as far as where these tamarisks now stand, or else they stood formerly on the bank of some brook which subsequently altered its course. The cause of their dying is of course in either case retrogression of the water. The schor on the southern side of this belt of vegetation assumes a somewhat different appearance. Although it still remains lumpy, it is at the same

time soft and dark brown, to the eye quite level and almost *au niveau* with the surface of the lake, which in the far distance looked like a faint white line.

We then crossed over another frozen brook, surrounded by patches of ice, and issuing from the Sasik-jar. From this position we perceived to the S. 74° W. the culminating point of the Kara-tschoka; while to the S. 9° W. rose a peak of the Tschimen-tagh at the right side of the entrance to the glen of Korumluk. But the loftiest mountain in the entire region is the Schia-manglaj.

Then we approached a region of ice-sheets, stretching in every direction; between them were ice-free stretches, in which the soil was so soft and miry that our animals sank in up to the knees. Where the ice bore, it was better to keep to it, but often it was as thin as paper and broke under us. These sheets of ice



have however nothing to do with the lake, but are formed by overflow water from the stream that gathers up the spring-fed brooks of the Tschimen valley, of Temirlik, and its neighbours. A little south of them the principal stream enters the lake. On its flat muddy shores there were clumps of very thick, tall reeds; otherwise they were perfectly barren. We formed Camp C on the hard-frozen bank of the stream and close to its mouth. The lake appeared to be covered with ice for as far as we were able to see, so that a trip across it was not to be thought of; nor would the ice have borne us, had we thought of walking across it and measuring the depth through holes chopped in it. We were only able to go about 2 km. to the south-east. In that direction the ice was uneven, being lumpy, ridged, and cracked, while here and there were strips of water that appeared to have but recently arrived. The lake was here so shallow that in places its bottom even showed up through the ice. At the point where the thinness of the ice compelled us to turn back, the depth of the lake was 0.58 m. and the ice 3 cm. thick. The farther we advanced from the mouth of the stream, the thinner grew the ice; thus it was evident that it was only the fresh spring-water that had frozen, forming, at any rate in the western part of the lake, a coating of ice upon the top of the salt lake-water. This process is in a high degree facilitated by the extraordinary shallowness of the western part of the lake.



Fig. 202. ICE SHEETS NEAR GHAS-KÖL.

This hurried visit showed us at any rate that the Ghas-köl is a small salt lake surrounded by an extremely flat region of marshy and saliferous mire. The configuration of the circumjacent country warrants the conclusion that the lake itself is very shallow; indeed it is probable that in the middle it is not more than a couple of meters deep. For this same reason it would have been difficult to examine it

by boat. One of my men declared, that there was only one point at which it was possible to launch a boat, namely in the district of Bel on the south side. That point, with its yellow *kasch* or »shore terrace», was visible from our camp to the S.  $40^{\circ}$  E., while Kumutluk was seen to the S.  $45^{\circ}$  W. and Tschigelik to the S.  $80^{\circ}$  E. North of Komutluk there are reported to be several marshes (*schapang-su*) and pools along the shore. There is also a marginal lagoon on the flat land in the eastward continuation of the lake. The two visits that I have paid to the Ghas-köl are not sufficient to determine its shape; it appears however to be elliptical, its long axis running east and west. North of Komutluk it seems to send out a narrow bay towards the west, and this we now crossed over on the ice. On the whole the lake is broadest in the west and narrows towards the east. Its absolute altitude is 2837 m.



Fig. 203. THE SAME.

Originally this lake, or rather this flat, barren salt-marsh, would appear to have owed its formation to the stream of Jusup-alik and its tributaries. We have, it is true, ascertained that this stream disappears in the district of Bagh-tokaj. After that it flows underground and reappears in the numerous springs, that form jars, in the Tschimen valley. Thence the water again flows on the surface, until finally it enters the lake. The lake is fed exclusively from the west, and the inflow there is constant. It is only occasionally that there is any influx from the north and south, e. g. from the glen of Mandarlik. On the other hand, there is no feeder from the east: the flat Tschimen valley merges with the basin of Tsajdam without any water-divide to speak of. The western feeders are said to enter the lake at three separate places. The largest of these is the stream formed by the union of the Tschong-jar, Kulak-jar, Temirlik, and Usun-jar, all of which conjoin not far below Temirlik to form one stream, which, after picking up the Basch-malghun, enters the lake at Camp C. South of that the Ajiklik-ileghi and the Tschalma-jar

flow into the Ajiklik-köl, a small freshwater lake lying west of the Ghas-köl, which is reported to be almost entirely overgrown with kamisch and to possess treacherous shores, marshy morasses with an abundance of vegetation. From the eastern end of the Ajiklik-köl there issues an emissary which discharges into the extreme western part of the Ghas-köl. The Sasik-jar and the Kurghan-ileghi are said to unite a long way farther down, and to empty themselves at the north-west corner of the lake. The main stream, beside which we were encamped, forms a delta of flat alluvia projecting into the lake. Seeing how clear the spring water is, it is astonishing to find such a delta; but probably it is due to an intermingling of rain-water, which occasionally comes down by these same spring-fed watercourses. The river was covered with ice 26 cm. thick, clear and full of bubbles. Its bottom was extremely shallow and the country on both sides of it appeared to lie lower than the river itself, though this may have been an illusion, caused by the arched icy covering having been uplifted somewhat by the underflowing current (fig. 205). At the edges of the river the ice-sheets did not touch the bank, but the edge was sharp and tapering as a sword-blade (fig. 206). I was unable to ascertain anything definite with regard to the salinity of the lake. In a specimen of the water which we took as far out as the ice would bear, the areometer gave a sp. gr. of 1.096.

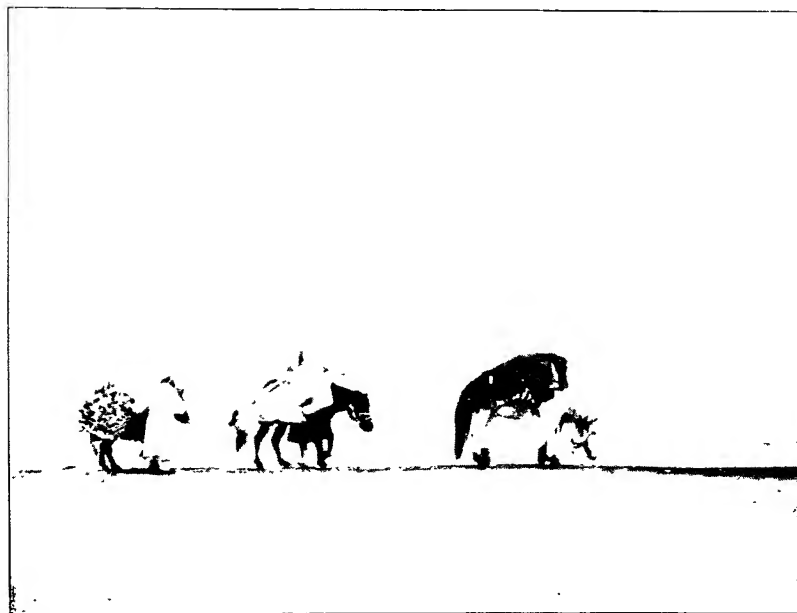


Fig. 204. WE MAKE A SAND PATH OVER THE ICE OF THE RIVER.

Yet as this was taken quite close to the river-mouth, it may be inferred that the water in the eastern parts of the lake must be extraordinarily salt, and it is probable that it never freezes there. If it does freeze, it will be because the fresh river water spreads itself out as a thin sheet all over the lake.

With the view of supplementing what I have said above, I will now add certain information derived from the natives, though this is not always so reliable.

From the point where I crossed over the Komutluk in the summer the extreme western end of the lake was said to be about 8 km. to the north-north-east. Bel is 5 km. distant, and from Tschigelik the distance to the little eastern lake is said to be shorter than that to the large lake. The distance to the latter was determined in the following original way: A man could travel on foot to the east end of Ghas-köl, there shoot a kulan and flay it, and then return on foot to Tschigelik, all in one day, without being overtaken by darkness. The Tschigelik-su, which seems to be a spring-fed brook, and the Samsak-ajding both enter the little eastern lake from the south. The brook of Boghan-otak is stated not to reach the Ghas-köl; but fresh springs gush out below it, forming another brook that enters the lake. The brook of Komutluk discharges a little east of the brook of Ajiklik, and a ravine proceeds



Fig. 205. ARCHED ICE COVERING.

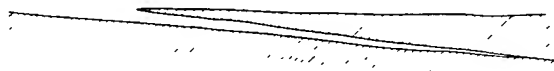


Fig. 206. SHARP ICE-EDGE.

directly from Bel to the lake; but torrents that are formed after rain are stated to issue from the Komutluk-saj and to empty themselves into the lake between Bel and Tschigelik. But no matter how much it rains or how great the inflow into the lake, its level is reported always to remain the same, so at least the kulan-hunters say who have visited the lake at different seasons of the year. The statement would however seem to require confirmation. The extensive flat, saline shore region bears unmistakable indications of having been under water, but whether it is inundated at certain seasons or whether the indications simply mark a former extension of the lake is difficult to determine. If the latter is the explanation, then the Ghas-köl is advancing towards the same destiny as most of the Tibetan salt lakes, and it is gradually drying up; hence it is probable that it is in process of shrinking. On the other hand, it is doubtful whether the lake remains uninfluenced by the varying amounts of its inflow; for in consequence of the flatness of its shores, even the slightest rise in its level makes itself apparent in both its area and its contour. With regard to its name, the Mussulmans call it Ghas-köl or Tschimen-köl, while the Mongols call it Ghas-nur, or quite simply Ghas. The Akato-tagh, which borders the basin of the Ghas-köl on the north, is said to end half a day's journey east-south-east of Dabso, a spring lying one day's journey east of Tschigelik. At the point indicated a sandy desert begins, and in it the range is said to die away and disappear. The Tschimen-tagh, on the other hand, which borders the basin on the south, extends a long way to the south-east, into Tsajdam; it was for this reason that Przhevalskij called this range Tsajdamskij.

On 15th December we directed our march from Camp C north-north-east towards Julghun-dung. After going 3 or 4 km. only we left the extreme northern



UP THE GLEN TO THE AKATO-PASS.



*Linstr. A. B. Lagrelius & Westphal.*

THE SAME.



part of the lake behind us, and traversed the same flat dreary region, formerly inundated, as on the day before. There were however a few stalks of kamisch in one or two dry watercourses, but that was all. On the other hand the belt of withered, languishing tamarisks on mounds, that I have spoken of above, was entirely absent here. We once more crossed over the ice-sheets of the Sasik-jar and the Tasch-uj; these two brooks are reputed to unite immediately east of our route in a district called Tajighlik. From the distance we could see how the ice-sheets branched and spread out radially, indicating that the brooks break up into deltaic arms.

The spring of Julghun-dung, where we halted (alt. 2865 m.), formed a large sheet of ice between the low, soft clay hills, dotted over with starved tamarisks; it is from these that the place derives its name.

On 17th December we set off for the Akato-tagh, travelling N. 60° E., carrying with us ice to last four days, for there was reason to believe that the regions we were now approaching were practically waterless. It was with a good deal of eager interest that I started upon the journey through this the northernmost part of the mountain regions, for no European had ever set foot there before me. Nor did any of the men whom I had with me possess even the slightest knowledge of the rounded dome-shaped, greyish yellow, barren Akato-tagh; indeed none of them had even so much as heard that any native had ever attempted to cross over that part of the range. I had therefore, on 16th Dec., sent on men in advance to find out whether the glen which appeared to be the most favourable could be traversed with camels; and they had reported that it led up to a pass which we could use. Due north of Julghun-dung the range appeared to be rather lower; but a reconnaissance in that direction also had convinced us that the glens there were scarcely passable even to men on foot: they were rather narrow gorges, deeply excavated, very steep, and excessively fantastic and capricious. Towards the north-east however, although the crest is higher, the ascent is longer and easy.

The belt of hills with vegetation, which evidently is connected with the similar belt of Tschigelik-kasch, came to an end immediately north-east of the camp. It forms a narrow strip a short distance from the foot of the mountains, and bears a striking resemblance to the belt at Dunglik along the northern foot of the Astin-tagh. Both strips consist of small hills, and their vegetation is made up for the most part of tamarisks and kamisch. This regularly arranged vegetation is undoubtedly due to the moisture from the adjacent mountains: that the moisture here does approach near to the surface is evident from the slight depth of the well of Dunglik, and the fact that the spring of Julghun-dung emerges here into daylight. And in both cases it is the vegetation that gives occasion to the formation of the small hills, in that its roots bind the loose material together and consolidate it.

After passing a final strip of vegetation at close quarters, we again had before us the tolerably hard saj with coarse sand and a sprinkling of gravel. All at once the country became absolutely barren; there was not one scrap even of wind-driven dry scrub to be seen anywhere. A short distance below the entrance of the

glen for which we were aiming I stopped and took some compass-bearings. To the N.  $22^{\circ}$  W. and N.  $40^{\circ}$  W. we perceived lofty dome-shaped bosses of the main chain of the Akato-tagh, with traces of snow in its sheltered crevices. To the N.  $66^{\circ}$  W. was an isolated hill standing below the mountain foot; to the S.  $5^{\circ}$  W. the entrance to the glen of Korumluk-saj; to the S.  $13^{\circ}$  E. Tschigelik and the entrance of Mandarlik-saj; to the south-east the last promontory of the Akato-tagh that was visible in that direction. For as far as we were able to see in that same direction the range appeared to preserve a pretty uniform altitude, and to be without any such important swellings as occur to the north-west. Towards the south-east we estimated that there were about 100 glen entrances, all decidedly small and situated quite close to one another. Although there were several glen openings pretty close to us on the north, yet between Julghun-dung and our glen we did not cross over a single watercourse in the saj; so that the rainwater which



Fig. 207.

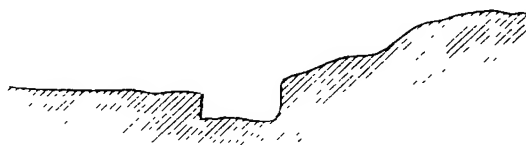


Fig. 208.

occasionally courses down out of them does not even reach the upper saj. I may however add, that the ascent of the latter towards the mountain-foot is quite imperceptible to the eye, and is but very slightly broken. It is quite possible therefore that the eroded watercourses of the glens that we saw to the north gather into common main stream, which in that case must lie west of Julghun-dung, and no doubt joins the brook of Tasch-uj. At all events it is characteristic that the surface rises so extremely gently from the Ghas-köl up towards the southern foot of the Akato-tagh, while the ascent from the lake to the outlet of the Mandarlik glen is very perceptible. Now the Ghas-köl lies pretty nearly in the middle of the Tschimen valley, at about the same distance from the Akato-tagh that it is from the Tschimen-tagh. But if we go a short distance farther west, to the region where we previously crossed over the range by two different routes, we find that the characteristic feature I have just alluded to is even more accentuated; indeed not only does the surface there not rise towards the foot of the mountains, it actually falls, and that on both the north and the south side of the Akato-tagh. For instance we found the Usun-schor lying close to the foot of the northern mountains and the Köl or Tschimen-köl at a very short distance from the foot of the southern mountains; and again to the east of the Tschimen-köl we found, that all the spring-fed brooks keep quite close to the foot of the Akato-tagh. Thus the Akato-tagh



risers in this region out of a sort of depression (see fig. 207). From the Upper Astin-tagh the surface slopes gently down towards the south; from the Tschimen-tagh it slopes gently towards the north, and where the two slopes meet rises the peculiar, but gigantic, upswelling called the Akato-tagh or the White Pass Range. In this way two latitudinal valleys are formed, sloping transversely in opposite directions.



Fig. 209. ENTRANCE TO THE GLEN.

The glen which we then entered has a rather narrow throat, about 100 m. across; the drainage channel itself is there 5 m. broad, and 1 to 2 m. deep, cut through the clay. It clings close to the foot of the left, or eastern, side, consisting only of small and pretty low hills and spurs; so that the jar or erosion terrace is the more developed on the left side (see fig. 208). After emerging from the glen, the watercourse assumes a southerly direction, and at the same time grows broader and shallower, and is soon lost to sight. It is no doubt a rare occurrence for the water that it brings down to reach as far as the Ghas-köl. From the entrance of the glen we had a view of the whole of the little salt lake; but we were unable to say whether it were ice or water that we saw glittering in it, though ice was the more likely, for during the preceding night there had been  $-29.6^{\circ}$  of frost.

We rode all day up this narrow glen, which had a very gentle ascent, while the bottom of the stream was as hard and as easy as an asphalted street. The only inequalities we encountered were the little low terraces formed by the water grooving runnels in the clay. The glen was like a tunnel, with short, sharp turns; we were seldom able to ride more than 3 min. in the same direction, before a fresh buttress rendered it necessary to take a fresh compass-bearing with a deviation to one side or the other. The surface consisted exclusively of fine yellow clay, moderately hard, its lie being almost horizontal or at  $2^{\circ}$  towards the S.  $50^{\circ}$  W.; such

exceptions to this as occurred seemed to be due to local dislocations on a small scale. It is owing to this soft, perishable material that the modelling energy of the water is attended by such clearly defined results, and indeed the relief is in a high degree wild and strongly marked. On both sides of the glen there are endless small lateral glens and ravines, very often not exceeding 1 m. in width at their lower extremities. Glancing up one of these rocky portals, we had generally a pretty distant view of the side-glen, joined in its turn by an endless number of miniature 'glenlets', the head of the side-glen itself being closed by a lofty part



Fig. 210.

of the mountains, the backbone of the spurs which jut out on that side of the Akato-tagh. Everything was dead and desolate, not a sign of either animal or plant; even the ravens, which were generally wont to keep company with the caravan, failed to find their way in here. The region was perfectly still and peaceful. How different is Nature in the glens of the Akato-tagh as compared with those of the Tschimen valley, near though the latter is to the former! In the Tschimen valley we had fresh brooks, abundant vegetation, and animal life, including wild-yaks and kulans, wild sheep, antelopes, wolves, and marmots. Here on the other hand, not so much as a fly, not a single drop of water! No glen on the moon's surface could be more dreary! And yet it is rather a picturesque and attractive region, sketched in bold, strong-featured outlines.

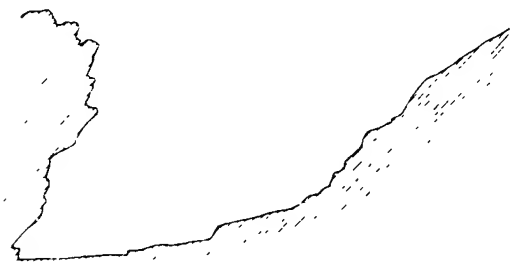


Fig. 211. OVERHANGING PART IN THE GLEN.

The side-walls are often vertical; indeed they sometimes overhang at the inner angles of the bends, where erosion has eaten its way into the clay, so much so that in places there actually are grottoes and caves. In these localities the bottom of the glen is sometimes choked with stones of every conceivable form: cubes, spheres, squares, and thin plates lay there as warnings, while other fragments clinging to the walls above looked as if they only needed a single shower to bring them down too. In some places the opposing elbows approached so close that we had to keep a sharp look-out lest the camels' loads should knock against them, and so cause a fatal land-slide from above.

The bottom of the glen as seen in cross-section is a perfectly straight line. When it contains water, this glen must be inconceivably slippery, and it would be impossible to traverse it with camels. At that time however there was not the slightest sign of moisture, and the surface was so hard that even the iron shoes of the horses left but a faint impress upon the clay, the camels making scarce any mark at all.

On the whole the glen winds very considerably, first north, then north-north-east, north-east, east-north-east, north, north-north-west, and north-west, indeed



THE GLEN LEADING TO THE AKATO-PASS.



*Ljustr. A. B. Lagrelius & Westphal.*

THE SAME.



sometimes for short distances it runs to the south-south-east. At length it widens out and loses entirely its character of a gorge. The slow ascent had ultimately carried us so far up that the relative altitudes were quite insignificant, and we appeared to be riding merely amongst low hills. Every now and again we came across a solitary scrubby köuruk, causing us to wonder how these plants manage to subsist, seeing that they are so seldom watered. Occasionally too we saw the dry, withered stalks of teresken, but these had been brought down by the torrents from higher regions. Every now and again the bottom of the glen contained gravel, though otherwise it still continued to be covered with clay. To the east of our route we now perceived a reddish ridge, the main crest of the Akato-tagh; and to the west also there were rather imposing spurs of the same range. Thus the country was now more open, the view not being impeded by any near mountains. Here we pitched Camp CII at an altitude of 3345 m.

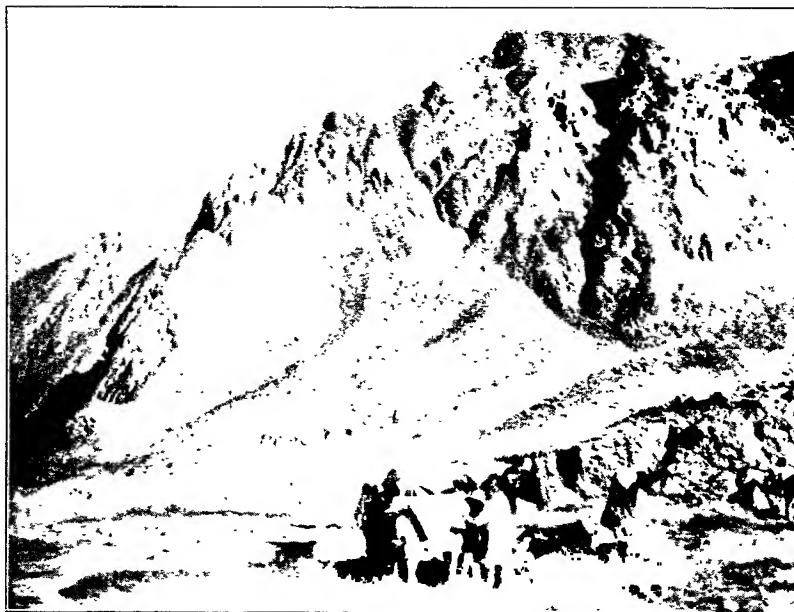


Fig. 212. VIEW FROM THE AKATO GLEN.

We discovered the first hard rock in the vicinity of this camp. It consisted of a variety resembling argillaceous schist and had a distinct dip of  $54^{\circ}$  towards the S.  $30^{\circ}$  W. In places it appeared to be in a transitional stadium, verging towards the condition of the all-prevalent softer clay, for when struck with the hammer it crumbled to dust. The impression I derived was that the entire range is undergoing a process of disintegration, crumbling all away to sheer dust and clay. In some of the steep walls of the main glen we perceived certain grey bands showing up very distinctly; those that I was able to reach consisted of coarse sand. The detritus in the bottom of the glen, though it was not only thin but rare, consisted of grey granite, diorite or diabase, porphyry, quartzite, and so forth. In fact the entire architecture and shape of this part of the Akato-tagh is, as the foregoing account

will have shown, remarkably singular and peculiar. Instead of having a range with a denticulated crest, outstanding peaks, distinct spurs and ramifications, separating large and well marked glens one from the other, as in the Tschimen-tagh and the Astin-tagh, we have a gigantic lump of a mountain, suggestive of a continental loaf of rye-bread or an inverted spoon, composed of clay and grooved by countless miniature glens and deeply excavated narrow gorges. On the following day we were to reach a region in which these peculiar relief features were still more emphatically in evidence.



Fig. 213. THE VALLEY IN THE AKATO-TAGH. CAMP VII.

December 18th. For some distance after leaving our camp we travelled along the bottom of the level and easy glen, until we came to a spot where two glens unite, the main glen from the north-north-west and a side-glen from the north-north-east. As my scouts declared that it was the latter which led up to the principal pass, we accordingly followed it. It wound about in a disagreeable way, and was so narrow that the camels entirely filled it from side to side, so that we were unable to get past them. From the upper part of this glen a very short, steep acclivity leads up to the pass, and up it we had to make a zigzag path with spades and pick-axes. The view from the top of this little rounded pass (alt. 3466 m.) was very peculiar. We were in the midst of a chaos of hills, ridges, crests, and irregularities, all greyish yellow and desolate, forcibly suggesting a sandy desert with its dunes



*Lynth, A. B. Lagyrlus & Westphal.*

THE RIGHT SIDE OF THE VALLEY AT CAMP CU.







THE AKATO-PASS OF DECEMBER 18.



*Lt. A. B. Lagrelus & Westphal*

THE CAMEL WITH MY YURT ON THE SAME.



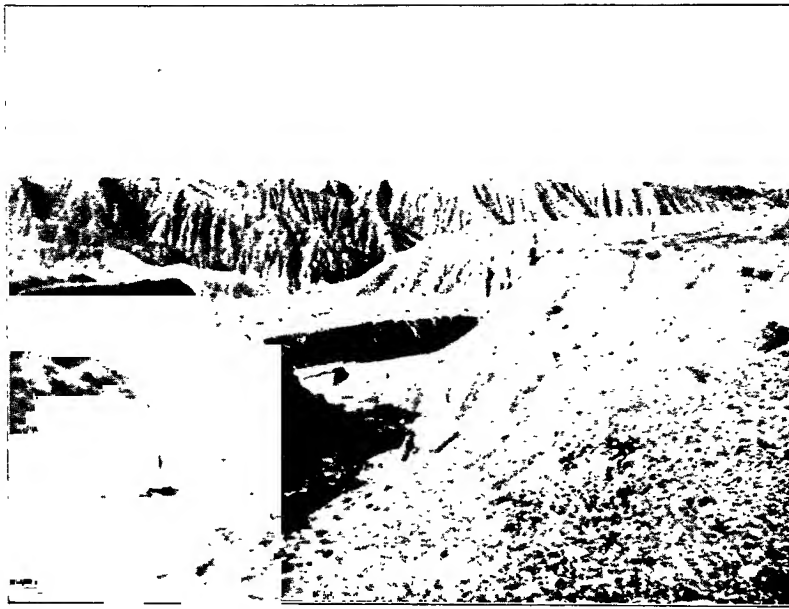


Fig. 214. CHARACTERISTIC MOUNTAIN-SCENERY OF AKATO-TAGH.

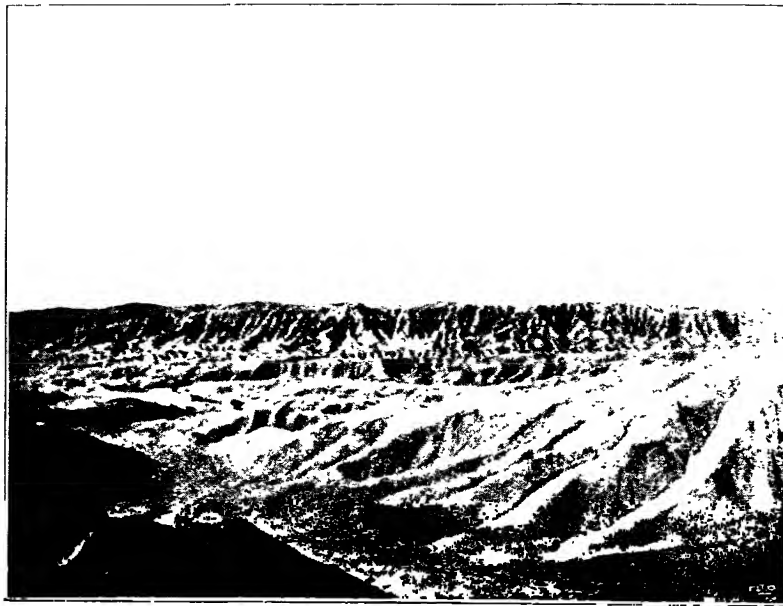


Fig. 215. SHOWING THE FLAT SURFACE AND THE DEEP VALLEYS OF AKATO.

rather than the culminating crest of a mountain range. Although it was evident that we were standing on the summit of a pass, there was nothing whatever, either to the east or the west, to suggest a main crest. It was everywhere one uniform level, without any specially outstanding ridges. Nor were we able to make out in which direction the transverse glen ran that descended on the north side of the range. It appeared to extend only a couple of hundred meters towards the north-east, and

then became entirely swallowed up in the labyrinth of yellow hills. To the S. 60° E. there appeared to be a depression, and beyond it was perfectly level country, stretching for a long way without any bounding hills. That was the basin of Tsajdam, and we were clearly standing on the eastern extremity of the Akato-tagh and were not very far from the point where the range sinks down into the lowlands.



Fig. 216.

A few hundred meters below the pass the glen swings away towards the south-east, describing the wildest of zigzags. The glen of the day before was strange and fantastic enough; but this easily surpassed it. At one place the eroded watercourse contracted to such an extent that a horse without a load would have been unable to get through, and even a man on foot had to use great caution in

squeezing himself past. But fortunately the hills and declivities on the right-hand side of the glen afforded a means of advance.



Fig. 217. TWO STOREYS.

And the farther we proceeded down the glen the more numerous these narrow passages became. Very often the camels with their loads collided with both sides at once, and projecting and menacing corners had to be cut away with axes. At the next difficult passage the glen presented the following profile (fig. 216): the eroded watercourse has eaten its way deep down in underneath the clay wall on the left side of the glen, so that the latter forms an overhanging shelf, cracked through and through, and looking very perilous. The bottom of this narrow channel is choked with a mass of stones, which we had to break in order to secure a pathway across them. Here the glen consists of, so to speak, two storeys, as will be seen in the illustration (fig. 223). It was impossible to proceed along the bottom of the upper storey owing to the slopes being too steep; besides, it is gapped with fissures to such an extent that it looked as though it might any moment come down. Moreover at every bend or angle of the glen the upper terrace is interrupted by the deeply trenched side-glens, with precipitous walls, which there come down to join the main glen.

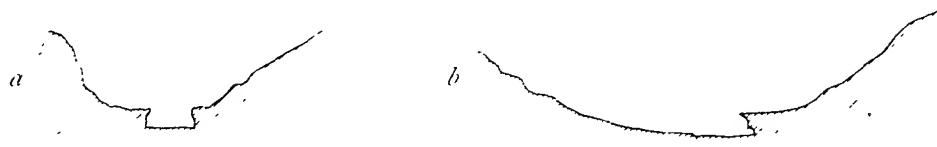


Fig. 218.

After that the glen was for some distance easier, and exhibited the profile shown in fig. 218, *a* showing the watercourse where it runs straight and *b* where it bends: the eroded bank forms an overhanging terrace, whereas the opposite side has the ordinary flat appearance of an alluvial bank. The former had here as a



ON THE TOP OF THE FIRST AKATO-PASS.



*Ljustr. A. B. Lagrellius & Westphal.*

THE LAST STEPS TO THE PASS.





SURROUNDINGS OF THE FIRST AKATO-PASS.



*Ljustr. A. B. Lagrelius & Westphal*

THE SAME.







Fig. 219.

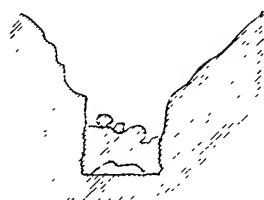


Fig. 220. THE TUNNEL.

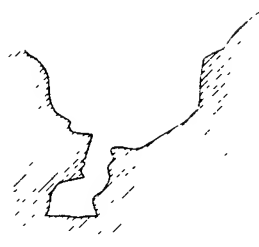


Fig. 221.

rule a breadth of 2 to 3 m. Easy though this glen was to march down, it was all the more difficult to map owing to the countless number of small elbows or bends it makes. We were seldom able to advance more than 1 or 2 minutes in any one direction; occasionally we might go 4 minutes, but never more. At the same time these elbows form sharp angles, so that one moment we would be travelling to the south-east and the next to the north-north-west. Within these stretches of 1 to 2 minutes there were often a dozen minor bends, all which however I was able to see at one time. Repeatedly the view ahead was impeded by small promontories and platforms jutting out across the glen. And up above it on both sides towered the stupendous masses of clay, great spurs of the main range, their flanks plunging vertically down towards the glen, seamed with the most fantastic clefts and gaping fissures and ravines. The relative altitudes between the bottom of the glen and these embracing walls continued to increase. In two places there



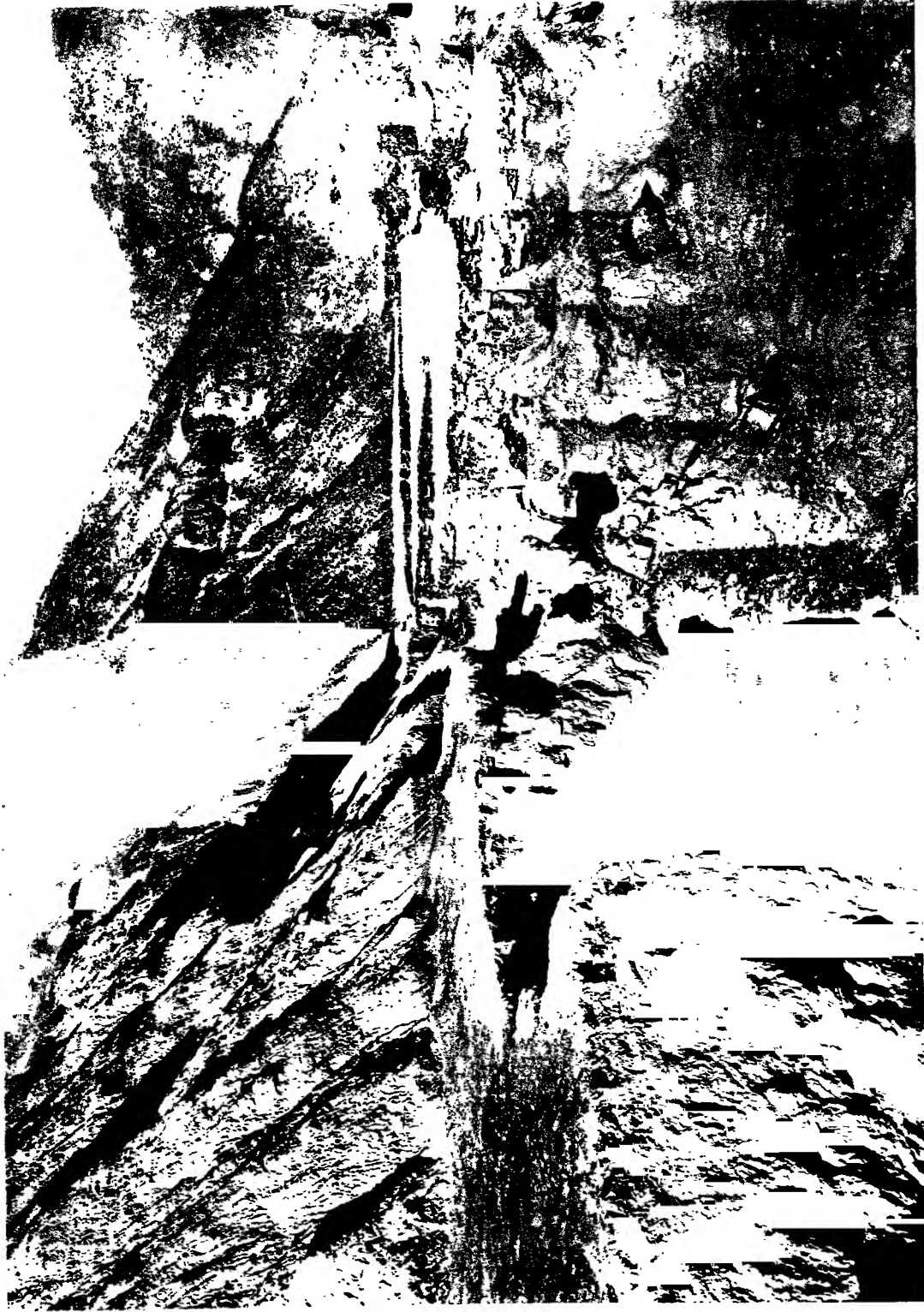
Fig. 222. THE TUNNEL.

was a suspicion of snow; had it been melted each would perhaps have filled a tumbler. At one narrow place the bottom of the glen was choked by a block of clay, probably 2 cub. m. in dimensions; this had to be cleft asunder before we were able to proceed.



Fig. 223. WHERE THE DIFFICULT PASSAGE BEGINS.

Meanwhile the glen was growing more and more extraordinary. The immense mountain-masses on both sides seemed to be drawn into more and more intimate contact, until we felt quite lost in the deep, narrow, gloomy defile. At length we reached a spot where a long time ago avalanches of clay have fallen and completely stopped up the glen. Since that happened the torrent has succeeded in forcing its way through the impediment, leaving a tunnel behind it, which yawned upon us as we came down the glen like the hollow front of a glacier. We could indeed have carried the caravan over the top of the tunnel as upon a bridge, only on the other side of the avalanche the glen was absolutely impassable. Its appearance is shown in the accompanying illustration (fig. 222). It was then but 1.2 m. broad, but 15 m. deep, and was cut straight down through the soft material without any enlargement of width (fig. 217). Nevertheless the two storeys were distinctly perceptible, the lower being the watercourse or bed of the torrent. After the caravan had advanced as far as ever it was possibly able to get, I continued a little way farther on foot. In some places it was dangerous even for a man on foot, and so narrow that I literally had



*Lynce A. B. Lagardius & Westphal*

THE IMPASSABLE VALLEY OF THE AKATO-TAGH



to squeeze myself through. All the time I was walking on the débris of the landslide and the bottom sloped down so steeply that it was like walking on a ladder or stairs. Abovehead were several big masses wedged in between the two vertical walls. Yet even this constricted passage grew still worse, so that it was at last absolutely impossible to advance a step farther.



Fig. 224. THE EXPANSION WITH CAMP CHIL.

Thus the pass which we had chosen turned out to be a snare; it was not possible to cross over the Akato-tagh by that route. What the distance was between the point where we turned back and the lower end of the glen it would be difficult to guess, though I dare say it was no great distance. It is probable that, below the difficult passage which I have described, the glen widens out again before entering the great flat latitudinal valley that forms the eastern prolongation of the Usun-schor valley (*kakir*), expanding just before it melts into the Tsajdam basin. From the point where I turned back I sent a man a little way farther down the gorge; but he was stopped at a point where the narrow watercourse was completely blocked up by a recently fallen land-slide. All attempts to advance along the sides were in vain, partly because of their steepness, partly because of their being gashed by impassable torrents. It was as though the sides of the glen had collapsed, and the glen itself become choked with avalanches of solid material, through which the torrent had had to cut its way anew. It is only in a range built up of such soft

and perishable material as this that such an unusual formation could arise. In the latest land-slide, the one lowest down the gorge, the torrent had not yet excavated a tunnel for itself, though there probably is some underground, invisible continuation. At the point where we turned back the depth of the tunnelled stream increased from 2 to 15 m. within a distance of only 200 m., and at the actual turning-point it was about 3 m. broad and 4 to 6 m. deep. Here the camels were unable to pass one another, but each had to be cautiously turned round on the spot where it actually stood. The accompanying illustration (fig. 223) shows not only the course of the eroded terrace, but also the bottom of the watercourse, which has a much swifter fall, going down by steps; this is the cause of the great descent.

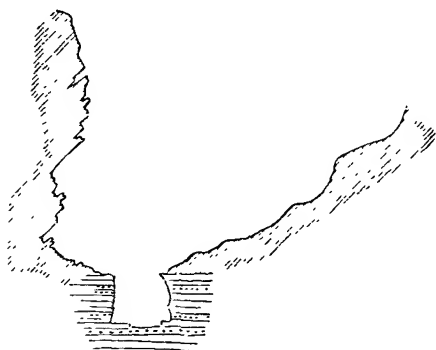


Fig. 225. STRATIFICATION OF THE CLAY.



Fig. 226.

The mountains which shut in this gorge — which runs towards the south-east and east — are considerably higher than those that border the glen by which we ascended to the pass. A profile drawn right through the range would have an appearance something like that shown herewith (fig. 227). As we stood on the top of the pass all the crests and ridges in the neighbourhood seemed to have approximately the same altitude. But both glens descend of course from the pass, so that the relative altitude increases.

The east-going glen contains a much greater quantity of detritus than that to the south-west. The yellow clay — small pieces were breakable in the fingers — was visibly stratified, and from the top of the pass down to our turning-point the several beds dipped as follows —  $14^{\circ}$  towards the S.  $50^{\circ}$  E.,  $20^{\circ}$  towards the N.  $85^{\circ}$  E.,  $35^{\circ}$  towards the N.  $60^{\circ}$  E.,  $75^{\circ}$  towards the N.  $55^{\circ}$  E.,  $22^{\circ}$  towards the N.  $30^{\circ}$  E.,  $75^{\circ}$  towards the N.  $55^{\circ}$  E. From the inclination of these strata it is clear that the deep narrow passage does not plunge straight down, but descends slantingly towards the north-east. Generally the dip is very distinct in that direction; all the same there was visible in the sides of the eroded watercourse a secondary, horizontal layer of fluvialite origin, the yellow beds of clay alternating with grey beds of coarse sand and fine gravel. The clay often formed sharp, projecting cornices and shelves. Traces of water were frequently observable on the sides above the eroded watercourse, where it had dripped and run down after heavy rain. In such places the bedding of the clay was entirely concealed by formations suggestive of stalactites and stalagmites (fig. 226), though these consisted of soft clay like all the rest of the region.

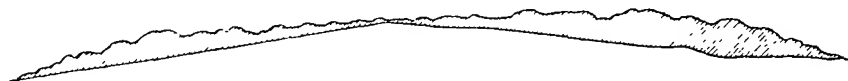


Fig. 227.

Camp CIII was formed in an expansion of the glen not far from the narrow passage. By that we had already got down to an altitude of 3086 m., or 400 m.



*Lystr. A. B. Lagrelius & Westphal.*

A VIEW FROM THE DIFFICULT VALLEY OF AKATO-TAGH.





below the pass. In this expansion the glen is joined by another similar glen coming from the main crest and running to the south-east. Had a fresh land-slide taken place above this camp, we should have been caught as in a rat-trap. On our way back up to the pass, the mountain-masses on both sides stood out more conspicuously than before; for without turning we were able to see all the way up each of the side-glens, which came down at an acute angle and had at their heads the mountain-masses in question. Camp CIV was situated a short distance above Camp CII, where the little side-glen leads down from the pass.

## CHAPTER XVIII.

### AN ANCIENT HIGHWAY — THE NORTH-WESTERN TSAJDAM BASIN.

December 20th. The main glen up which we were now marching was spacious, although only some two score meters across, sometimes no more than 15, and it grew of course increasingly narrower the higher we ascended. The relative altitude of the mountains was slight; we appeared to be surrounded by nothing but hills. Nor did the glen wind over-much, for we were generally able to advance several minutes, sometimes as much as 7, without any change of direction. On the whole we marched towards the north-north-west until we reached an expansion of the glen, and there we turned off to the north-east, entering a narrow glen that led up to a secondary pass, the real value of which it was difficult to make out; but we might probably have avoided it. Nevertheless, as my scouts had failed to discover any other pass over the Akato-tagh, we had no alternative but to cross by it. Here, as in the case of the former pass, it was only the ascent of the actual summit that was difficult, and yet this was not more than about 30 m. higher than the upper part of the glen. But in those 30 m. the acclivity was extraordinarily steep, and we were forced to cut a path, and convoy each camel up separately. From the top we had a magnificent view across the Tschimen valley to the south, though in the opposite direction we could not see very far.

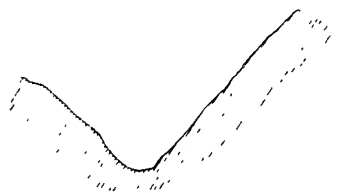


Fig. 228. VERTICAL SECTION  
OF THE GLEN LEADING UP TO  
THE PASS.

From the pass (alt. 3587 m.) we descended a little towards the north-east, and then entered another glen that led up towards the north. The portion of the mountain lying between the two passes sends out towards the south-east a narrow pointed promontory, curiously bent like a hook. The new glen had a very gentle ascent; its bottom was very narrow, its sides more regular. Higher up the steepness increased considerably. Both *teresken* and *köuruk* bushes were relatively plentiful between the two passes. This principal pass (alt. 3698 m.) was a good deal easier than the secondary pass, and we had no occasion to use our spades. The first pass, which we crossed on 18th December, had afforded us a view towards

the south-east and we saw the Akato-tagh melting into the basin of Tsajdam; but the view to the north had on the contrary been hidden by the higher parts of the Akato-tagh. It was on this higher swelling of the Akato-tagh that we now stood; nor could there exist any doubt about this being a principal pass, because we now commanded an extensive view to the north and in other directions, enabling us to note clearly where we were. We could even see the summit of the Astin-tagh away to the north, extending east and west as far as we were able to see. The crest of the Akato-tagh, in so far as one may speak of such, appeared to stretch to the S.  $55^{\circ}$  E., decreasing however in altitude, until finally it ceased en-



Fig. 220. THE SECOND PASS (AKATO).

tirely in level ground; while in the far off distance to the east-south-east and south-east we caught a glimpse of something that we were unable to identify exactly, — whether hills, clouds, haze, or simply a desert reflection. In the S.  $3^{\circ}$  E. we saw the extreme eastern end of the Ghas-köl, glittering intensely white. To the north-east, but nearer, was a very small ridge, running from north-west to south-east, and thus parallel with the Akato-tagh. Between them is a latitudinal valley, probably connected in the north-west directly with the *kakir* of the Usun-schor. Along the line by which we crossed over this great valley in the beginning of July we had noticed that it slopes towards the east; but neither what I saw from the pass nor the fresh diagonal crossing which thereupon ensued was sufficient to enable me to make out whether the slope continued without interruption all the way to the basin of Tsajdam or whether some minor self-contained basin does not intervene between my two routes. To the N.  $47^{\circ}$  E. there appeared a gaping transverse glen through the little ridge I have mentioned, forming an outlet for several of the temporary streams that drain the north-east face of the Akato-tagh. To the

N.  $55^{\circ}$  W. rose a more imposing swelling of the Akato-tagh, probably the same as that which when between Julghun-dung and the mouth of the glen I had observed to the N.  $22^{\circ}$  W. On the far side of the minor ridge there is again a latitudinal valley, situated consequently between the Akato-tagh and the Astin-tagh, and forming orographically the immediate eastward continuation of the kakir of Usun-schor; although it is uncertain, as I have said, whether farther to the west there may not exist one or more self-contained basins like that of Usun-schor and Kala-köl. With regard to its relief, this latitudinal valley is at any rate of quite a different character from Usun-schor, for it is decidedly broken and diversified by a number of small mountain bosses and hills. We now saw that the gorge, in which we had been compelled to turn back, terminated in the little latitudinal valley between the Akato-tagh and the minor ridge to the north-east of it.

Between the two passes that I have described we climbed up to the principal pass, which afforded us the view I have just sketched. We now entered the upper end of a transverse glen, which on the whole appeared to run parallel to the *cul-de-sac* gorge, and to be equivalent to it, and like it probably also terminates at an impassable barrier. To obtain a perfectly clear conception of the general orography of the Akato-tagh is almost impossible by reason of the capricious surface-formations, and one can only be sure of those glens and passes that one has actually traversed. Even when we stood on the principal pass, we did not derive the impression that we were on the summit of a distinctly outlined mountain-range running from north-west to south-east. On the contrary we seemed to be looking upon a number of parallel crests or ridges running from south-west to north-east; this is more particularly true of those parts of the Akato-tagh which lie to the west of our route. A peculiar illusion is also borne in upon one when standing on the top of the main pass, in that the strange system of argillaceous mountains by which one is then surrounded convey the impression of being very inconsiderable in point of elevation, so that one almost hesitates to call them mountains at all; while of the energetic features of the vertical relief one sees practically nothing. When one is, on the other hand, down in the glens, the impression is quite different; for when at Camp CIII we found ourselves surrounded by gigantic swellings and vertical mountain walls. The illusion is of course simply the result of the extreme narrowness of the eroded glens, which are also so deeply sunk that it is only from the bottom that their true relief becomes apparent.

Had the only object of this present excursion been to explore the eastern Astin-tagh and Anambaruin-ula, it would of course have been much the simpler plan to have made a detour right round the Akato-tagh, that is to have marched south-east from the Ghas-köl, to have doubled the south-eastern extremity of the Akato-tagh in Tsajdam, and then to have gone north, and approached the Astin-tagh travelling on perfectly level ground. But I preferred the more difficult and irksome road over the Akato-tagh in order that I might have an opportunity to check the delineation of the orography of the region shown on the map of the Russian General Staff, for *a priori* it appeared to me to be in the highest degree improbable. I have already pointed out that that map erroneously gives to the Ilve-tschimen and the Akato-tagh the name of Tschimen-tagh. But an even worse mistake is made

when it shows this range stretching east, north-east. and north from a point immediately east of Usun-schor, and fraternally embracing the Astin-tagh at a mountain-knot in the region south of Kum-bulak. The map in question is indeed suspiciously generous in similar mountain-knots, and in letting distinct mountain-ranges diverge from them in a way to which there exists in reality no counterpart whatever. The beautiful and consistent way in which the law of orographic formation that rules throughout the whole of Tibet, and not least in the northern parts of the Tibetan plateau, namely that the foldings of the earth's crust, the great mountain-ranges, form parallel elevations, is for the most part disregarded on the Russian map. The very mountain-knot, south of Kum-bulak, in which the Astin-tagh is made to culminate, is really a perfectly unwarranted invention, for, as I have sufficiently emphasised already, the Astin-tagh is in no sense a single range, but consists of two chains running parallel to one another; while of the diagonal range that stretches from Usun-schor to the mountain-knot there exists in reality not a single trace. Indeed one has every reason to be amazed at the carelessness of topographers who, in order to fill up a blank on their map, simply draw upon their own imaginations as they sit at their own study tables. Nor have they been content with merely depicting this imaginary range on the map: they have actually encircled it with four or five blue rings in sign of perpetual snow, so that it really stands out more conspicuously than even the stupendous Tschimen-tagh or the sharply outlined Kalta-alaghan; in fact it is delineated almost as emphatically as the Arka-tagh, the very backbone of Asia. On sheet 62 of *Stieler's Handatlas* this imaginary range has been a good deal toned down, but on the map of 'Tibet and the Surrounding Regions', issued by the Royal Geographical Society, it figures in all its pseudo-splendour. Thus as one result of the first few days of this present excursion I was able to eliminate from our maps a misleading and vexatious blunder.

From the principal pass, which reached an absolute altitude of 3698 m., we proceeded towards the north-north-east, keeping on a flat, rounded, rather steep ridge, which branches off from the crest of the range in which the pass is situated, and winds about in the same capricious manner as the glens in the same locality. One of these we had on our right hand, and into it we descended by a steep, stony ravine. This glen is fairly broad and has a gentle slope towards the east and north-east, and finally to the east-north-east, the mountains on both sides decreasing steadily in altitude until they eventually melt into low hills. The left terraced bank is a couple of meters high, and rounded, and after climbing up it we crossed over the little latitudinal valley between the Akato-tagh and the minor parallel range, dipping up and down into a number of small shallow watercourses, separated from one another by flattened elevations.

Our course then became northerly, and to the N. 50° E. we had the mouth of the transverse glen which I have already mentioned as gaping in the minor parallel range, and now resembling a deep-cut and constricted portal. Upon this opening all the eroded watercourses of the region converge, not only those off the flanks of the Akato-tagh, but also those from the country west of our route. Hence there must be, farther east in the latitudinal valley, a dividing ridge or threshold.

though it is certainly very low and flat, for in that direction there exists nothing to hinder the view; that is, the valley is open towards the south-east.

All the way down from the pass the country was perfectly barren, and all traces of animal life were of course absent. All that we saw of this nature in the Akato-tagh were the white and mouldering bones of a kulan in a narrow gorge, into which the animal had probably come in order to die in peace. In the latitudinal valley we now came across the footprints of a bear about a month old; the creature had evidently made its way down towards the transverse glen already alluded to.

By means of a flat and easy pass we crossed over the minor parallel range, which came completely to an end immediately west of our route. On its northern side we discovered a distinctly marked track, which my guides believed to have been made by Tungans. It is just as likely however that it was used by Mongol pilgrims. We were soon to discover its continuation and to come across proofs that human beings really had formerly visited these desolate regions. From the point where we crossed it the road alluded to ran towards the N.  $33^{\circ}$  E. and in the opposite direction towards the south-west, and consequently towards another part of the Akato-tagh than that in which we crossed over the range. May we venture to suppose that by following this mysterious path we should be led to an easy pass over the Akato-tagh? No; it seems to me more conceivable, that the route it follows runs along the northern foot of the Akato-tagh and crosses that range by the easy pass south-east of Usun-schor. After getting over four other dry ravines, we encamped in a fifth (Camp CV), where we obtained water from some small snow-drifts. The altitude was 3455 m. The ravines in question run towards the east, and gradually converge into a large outflow channel. North of the camp we had some small hills, and amongst them teresken scrub was fairly abundant.

The day's march proved to us that the northern slope of the Akato-tagh is very different from the southern. Up as far as the pass clay still continued to be predominant, and at Camp CIV the dip was  $31^{\circ}$  towards the S.  $30^{\circ}$  W. But in the principal pass an excessively weathered rock cropped out, possibly granite; it appeared to be bedded, although indistinctly, at  $70^{\circ}$  to the N.  $70^{\circ}$  E. On the northern face the clay contains a large admixture of gravel and coarse sand, and these appear to consolidate it, and so prevent the origination of the wild and fantastic surface features which we found on the southern, and especially on the south-eastern, face of the Akato-tagh. Another difference between the northern and the southern slopes is that, whereas the latter is about 30 km. long, the former is only 3 to 4 km. Nevertheless the kakir valley at the northern foot lies higher than the Tschimen valley at the southern foot. A similar difference, although less pronounced, may also be observed in the vicinity of the pass of Usun-schor.

December 22nd. We now had to cross over the eastward continuation of the great kakir valley, but by reason of the broken nature of the country this proved to be more complicated than we expected. From Camp CV we directed our course towards the east-north-east and soon came to another watercourse running towards the east; this picks up all the other watercourses in the locality, and developing into a large saj, follows the northern foot of a small ridge, a sort of offshoot of the Akato-tagh. This glen runs first towards the east, but gradually turns away

towards the east-south-east and the south-east, and soon appeared to be pretty deeply incised. It no doubt joins the eroded watercourse that forces its way through the minor parallel range and then runs to the north-east, though after the junction the united channel must proceed towards the south-east.

Having crossed over the eroded watercourse at its lowest part, we directed our march towards the north-east, and soon plunged into a labyrinth of hills and broken ground, in and out amongst which wind a number of dry watercourses, issuing from the lower heights which we saw towards the north-west, and all running down towards the principal watercourse. This last does not appear to be joined by any side-glens from the right, at all events in that locality, although it is so lower down, as we shall soon find.

At the point where we quitted the valley, we again came across the old road of the day before, and it now turned out to be a *tschong-jol* or highway with *iles*, or landmarks, set up on every dominating hill. These consist of small pyramids of stones, generally visible a long way off, and wherever doubt might arise as to the direction in which the track threads the hills, they stand closer together. The road itself is for the most part distinct, revealing itself especially in the hard gravelly and sandy soil as five or six parallel, faintly marked depressions or grooves, an indication that the route had been used by large companies or travellers with several horses marching abreast. In places the surface is so hard that it would require a very lively traffic to make even such grooves or tracks as those we saw. So long as we were marching towards the north-east we passed no less than 13 cairns of stones. The question naturally arises, what was the object of this road, now so completely forgotten? Did it belong to the period when, as one of my men, a hunter well acquainted with that region, declared, the Mongols of northern Tsajdam used occasionally to resort to the grazing-grounds of the Tschimen valley, and especially those of Temirlik? Or was it used by Mongol pilgrims bound for Lhasa during an unsettled and warlike time, when for fear of either Mussulmans or Tanguts, it was expedient to travel by such a back-road as this, situated as it is remote from all inhabited regions? Anyway it does not seem to have been a chance road, for in that case the users would hardly have taken the trouble to build up the cairns of stones. Nor does it seem to have been a pilgrim road, for in that case we should have found similar heaps of stones farther in amongst the mountains. Nor can we assume that this road was connected with the landmarks which we observed in the gorge of Toghri-saj, for that would have meant an unaccountable and unnecessarily long detour to the west. The first-mentioned supposition seems to me to be the most likely; it is indeed probable that the road dates from the time when the Mongols dwelt beside the Kara-koschun and had their flocks and herds in the mountains, and that it was used for the purpose of maintaining communication in summer between these Mongol settlements and those in northern Tsajdam and Särtäng, and lapsed into forgetfulness, perhaps indeed was never used, after the Mussulmans settled beside the Kara-koschun and the former Mongol inhabitants retired. Later on we shall come across this old road once or twice again.

It struck me, that by following this route we should have the best prospect of finding water in such an inconceivably arid region as that is; indeed in this

respect it reminded me of the Kuruk-tagh farther to the north. Accordingly we followed the road into a small pass in an insignificant offshoot running towards the south-east. Thence the hard sandy surface slopes slowly and evenly down towards the beginning of a fresh saj, which, unlike the foregoing, proceeds towards the north-east, being sunk 2 to 3 m. deep. This new glen, in which the teresken was fairly abundant, and two or three tiny snow-drifts had forgotten to melt away, led us, as I have said, first towards the north-east, but soon it inclines to the east, south-east, and south-south-east, deepening as it advances, although its fall is easy, regular,



Fig. 230. CAMP CVI.

and slow. Its bottom shows plain indications of water-channels and of flowing water, although it appeared to be a long time since any actually flowed that way. This glen is joined from the right by two pretty large side-glens. On that same side, that is on the south, it is bordered by fairly flat, but tolerably extensive, mountain slopes, apparently the south-eastward continuation of the parallel range already alluded to. Farther on, to the south-south-east, rises a chaos of small, and apparently innocent looking, mountains, though in reality they are possessed of the same inhospitable characteristics as the Akato-tagh. On the left, that is north-east of our course, there now appeared a rather isolated mountain-mass of some magnitude. Although we were being taken quite out of our direction, that is to the south-east, instead of to the north-east, we had no choice except to follow the bottom of the





*Lustr. A. B. Lagrelus & Westphal*

CAMP CVL.



glen. This gradually deepened. The country, when seen from the west, appeared to be tolerably level, but no sooner did we dip down into an eroded channel than we found ourselves at the bottom of it, and before we knew where we were, behold we were surrounded on all sides by soft, capricious heights.



Fig. 231. CAMP CVI.

The old road became lost to sight in just about the locality where the glen turns to the south-east, and it seemed to me that since the glen forced us to go in the wrong direction, we ought to turn back and accompany the old road. Nevertheless I sent out scouts down the glen from Camp CVI (alt. 3021 m.), and they reported that a little farther on we could get round the north-east angle of the detached mountain-mass, and then continue towards the north-east. At the spot where we pitched camp, we discovered to our great amazement a salt spring, the water trickling away in a tiny rill and forming thin, but sufficient, sheets of ice. Thus the Akato-tagh is not without its springs any more than the Kuruk-tagh is. The areometer gave a sp. gr. of 1.0125 and the water, at the point where it trickled out of the ground, had a temperature of  $+2.5^{\circ}$ . Excellent kamisch was growing round the spring, although in such small quantity that it was barely sufficient to satisfy the caravan. On the right side of the glen we found also a thicket of *boghana* bushes, some of which, being withered, afforded excellent fuel.

During the course of the day we passed hard rock in two or three places. The first small crest on the right-hand side of the upper part of the watercourse in the main glen consisted of a species of rock resembling greenstone, excessively weathered, and having a distinct dip of  $60^{\circ}$  towards the N.  $60^{\circ}$  E. A small pass with a heap of stones was situated in granite, and the pass in the little offshoot to the south-east was situated in hard greenstone with a distinct dip of  $50^{\circ}$  to the N.  $10^{\circ}$  E. The marginal terraces beside the large watercourse that we subsequently followed consisted of alternate layers of clay, fine gravel-and-shingle, and coarse sand, with a dip of  $12^{\circ}$  towards the N.  $10^{\circ}$  W. Every now and again its bed was littered with loose fragments and gravel of greenstone, granite, and quartzite, and so forth. The minor crests of the locality extend from west-north-west to east-south-east and round to north-west and south-east, and thus run parallel to the main chain of the Akato-tagh and the eastern part of the Tschimen-tagh, though not parallel with the double chains of the Astin-tagh, for these have in this meridian an east-north-easterly direction. Farther, we have found that the great kakir valley, which at Usun-schor, and a good bit both east and west of that locality, is so flat and level, is here greatly broken and so abundantly dotted over with small bewildering eminences that it has been deemed necessary to set up landmarks in order to point out the road.

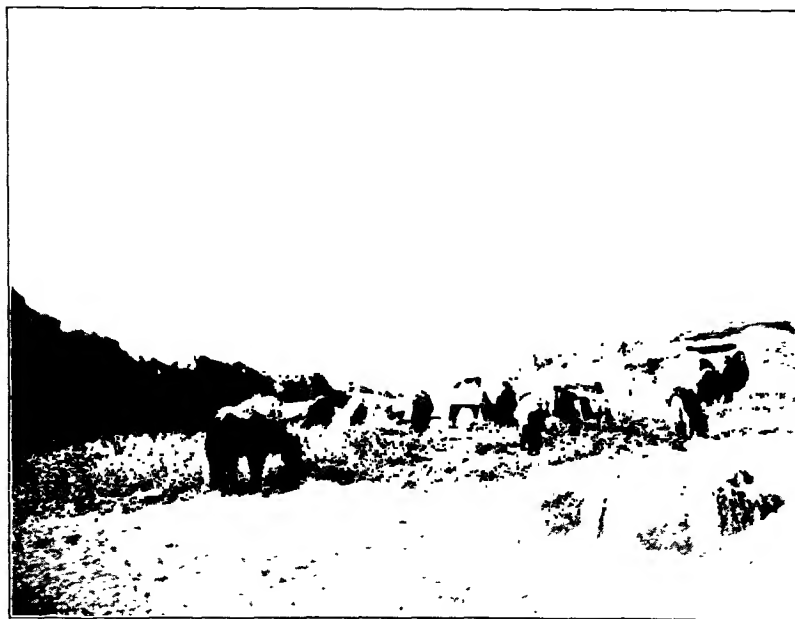


Fig. 232. GRAZING IN THE VALLEY OF CAMP CVI.

December 23rd. Strange to say, the ancient road which I have mentioned did not appear to touch the spring at our Camp CVI, at all events there were no landmarks in its locality; and my scouts maintained that from the point where we lost sight of the cairns of stones and the old road, the latter diverges more and more from our south-easterly route and goes due north-east. It is conceivable, that the



*Lynette, A. B. Langreth & Westphal*

CAMP CVI. TO THE RIGHT THE ICE-SPRING.

the ground was gently arched and rounded, quite an unusual and peculiar form of glen. Eventually the glen bifurcates, the principal section proceeding towards the east-south-east; we however kept to a gorge that runs east-north-east and soon found ourselves in more open country. After that elevations alternated with hard sandy soil containing hollows, the bottom of which was lined with rough lumpy clay. To the east the country is open and flat: it is there that the kakir of Usun-schor melts into Tsajdam, after being diversified by the small ridges which we had recently crossed over. From the south-east to the south-west we had the crest of the Akato-tagh, with its chaos of soft argillaceous mountains and labyrinths of winding ravines. Viewed from the relatively elevated region in which we then were, the Akato-tagh was like a series of rather low hills, and consequently very unlike the considerable swelling we saw from the Tschimen valley. A couple of kilometers to the north a minor latitudinal valley opens out between the last, that is the easternmost, ramifications of the minor mountains. The Astin-tagh now stood out in full view, unmasked and unscreened; it too appeared to be moderately low, although when seen from the lowlands to the north it presents the appearance of a gigantic mountain range.



Fig. 234.

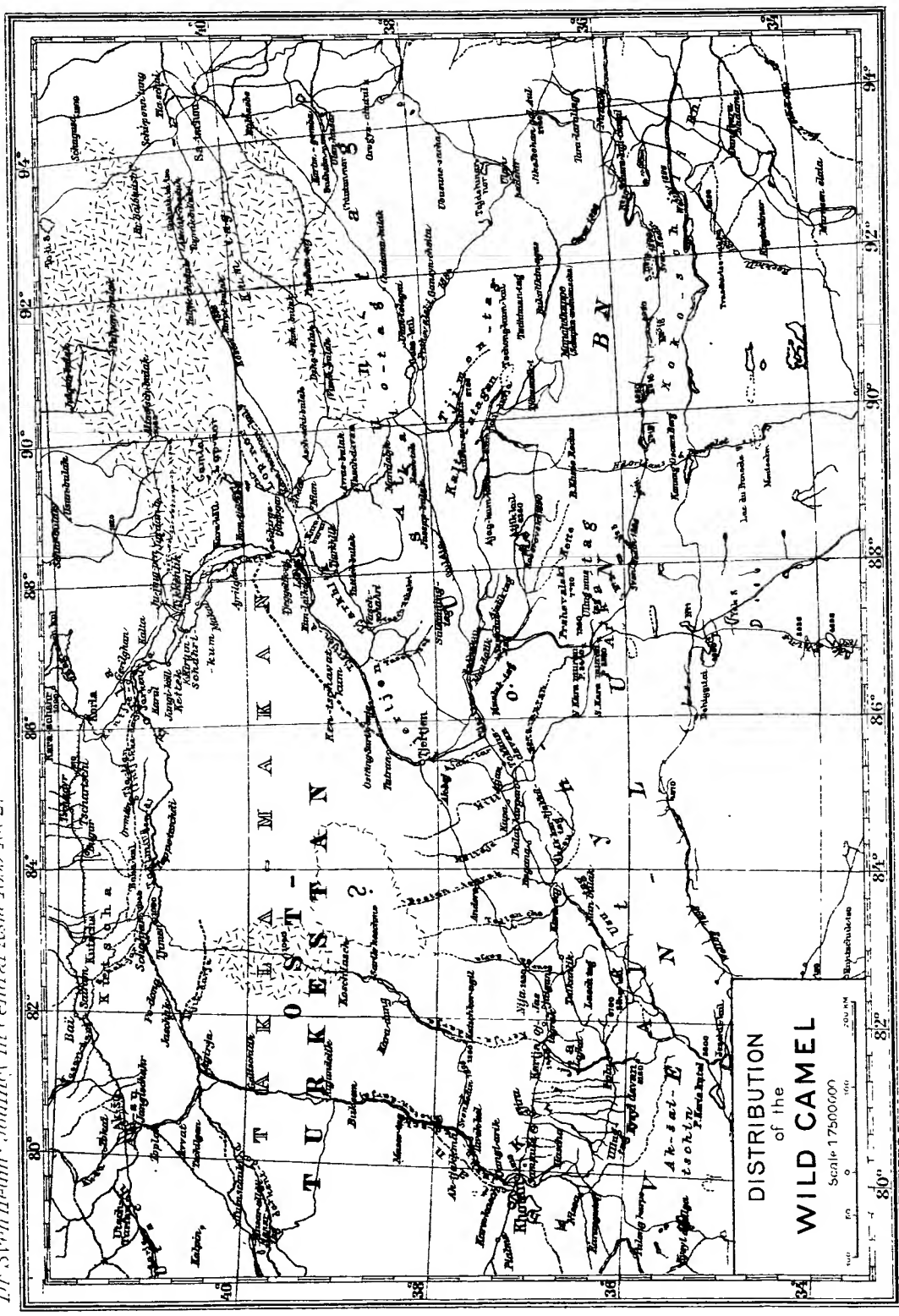


Fig. 235.



Fig. 236.

At length we left this hilly region behind us and came out upon the level country. On the right, that is to the south, we still saw the thousands of small detached eminences, though they soon came to an end towards the south-east; they stretch towards the S.  $55^{\circ}$  E., parallel to the crest of the Akato-tagh. The level country, which from the distance had appeared so easy and so inviting, turned out however to be extremely unfavourable and wearisome. Very unlike the hard, level, and excellent surface in the region of Usun-schor, the country here consists of rough schor and clay, dotted over with efflorescences of salt; being the result of the crumbling down of a number of riven crests, ridges, and thresholds, all stretching from north-west to south-east, and consequently lying at right angles to our line of march, so that we had to go up and down over them all. The ground itself was







as hard as bricks. This region looked as if it had formerly been a barren salt marsh, and as if the saliferous mud, when it dried, had expanded and then shrivelled like the skin of a withered apple. On the whole these ridges or corrugations reminded me of the »jardangs» in the Desert of Lop; but a closer examination revealed that, unlike these, they do not owe their origin to the wind. These ridges are hollow internally, that is to say they form crusts over empty spaces, which gape black through the numerous crevices. Yet so hard were they, that they almost always bore the weight of both horses and camels. At first they were 2, seldom 3, dm. in height, and the depressions between them generally about 1 m. broad. In outward appearance they resemble waves, as the accompanying profile (fig. 235) shows, having their steep side turned towards the north-east. With the object of getting out of this country, which is far worse to travel in, and more tiring, than the mazes of the Akato-tagh, we directed our march more towards the north, where there appeared to be level kakir, besides which the surface sloped in that direction. But we found that we had only stepped out of the frying-pan into the fire. The ridges were a meter high and were separated by hollows 3 m. across, although sometimes they stood quite close to one another. They were plentifully sprinkled with white salt, and in the hollows were rhomboidal, sharp-edged crystals of gypsum, which wounded the camels' feet. Often these ridges were like the curling crests of waves, and it was a wearisome waste of time to wind in and out amongst them or climb over them at the less elevated spots.

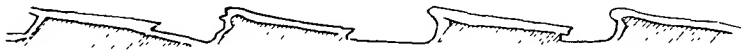


Fig. 237.

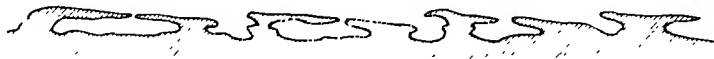


Fig. 238.

After that the country exhibited a highly peculiar and unexpected feature. Before we were aware of it, we were suddenly stopped by a precipice, descending by steps fully 70 m.. Here it seemed as though it would be impossible to get down with our camels. But along the face of the precipice ran, arranged regularly and amphitheatre-wise, as though they had been made by human hands, paths or passages, with a hard and level bottom, slightly strewn with sand and furnished with real parapets on the outer side, all composed of the same hard gypsiferous schor as before. A profile of this declivity is shown in the accompanying illustration (fig. 236). Upon applying the hammer to one of these parapets I found that it consisted internally of soft, yellow dust; thus the hard saliferous layer forms only a relatively thin superficial crust. The pathways are arranged tier above tier like the seats in a circus, and by means of breaches in them here and there, we were able to descend step by step until at length we found ourselves once more on the level ground below. Looking back from the bottom, I was struck by the resemblance which this protuberance or terrace bore to the brink of a gigantic lava-flow or a

mass of mud suddenly arrested whilst rolling onwards. The terrace stretches from the N.  $70^{\circ}$  W. to the S.  $70^{\circ}$  E.; a direction which seems to indicate that we have here the last surviving fragment, now almost entirely obliterated, of one of the former offshoots of the Akato-tagh, consisting of the same perishable material as the main range of the Akato-tagh itself, which is, as we have seen, only the shadow of a ruin of a mountain-range.

The surface at the foot of the terrace, which when seen from above had appeared perfectly level, was just as rough as the surface up above, the only difference being that the irregularities were of a somewhat different shape. At first they were like long tables and benches, with their tops tilted towards the south and consequently their steeper sides facing the north (fig. 237). Here too these superficial layers were generally mere crusts covering hollow spaces, and no matter how thin they were, they almost always bore the weight of our animals. Then another variety of this provoking schor surface succeeded, namely sharp outcropping edges and laminae, sometimes almost horizontal, at other times sticking straight up (see fig. 240), all consisting of the same hard material, which rings like a brick if a horse chances to knock against it or chip off a corner with its hoof.



Fig. 239.

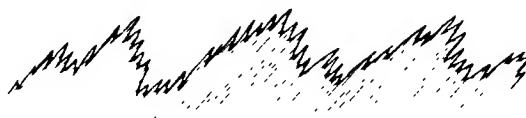


Fig. 240.

Our attempt to escape from this region had thus proved unsuccessful; and I have no doubt that the same features are characteristic of divers other parts of the basin of Tsajdam. Indeed we were now in the extreme north-western part of Tsajdam, or rather on the border-line between Tsajdam and the kakir valley of Usun-schor. I encountered also precisely this same disagreeable conformation in the extreme south-eastern part of Tsajdam in the end of October 1896, whilst travelling between Ova-tögörük and Tosun-nor, where the only breaks in the hard, rough schor surface were the channels of the Bajan-gol and the Bulungir-gol, and the courses of their numerous affluents and deltaic arms.

Our detour was however the means of our making an unexpected discovery, namely a spring in the midst of the flat desert, surrounded by extensive sheets of ice. Just beyond it and on the north was a clay terrace, with a thick bed of good kamisch, and even some tamarisks, which accompanied the outflow of the water in a long dark line. The water here was rather saltier than at the preceding spring, the areometer giving a sp. gr. of 1.0218, while its temperature was  $+0.5^{\circ}$ , though this was affected by the immediate proximity of the ice-sheets. Had it not been

for these two springs, which we hit upon by pure accident, we should have experienced considerable difficulty in crossing over this desert region, for there is no vegetation except in their vicinity, the desert being everywhere else perfectly barren. It would be very risky to attempt to traverse it at any other season except the winter, when ice can be carried from each successive spring in sacks; in summer one would be forced to make shift with the salt water. Our horses and camels drank the water of the spring at Camp CVI and enjoyed it, but at Camp CVII they refused to touch it.

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## CHAPTER XIX.

### THE WILD CAMEL — OVER THE ASTIN-TAGH.

Upon reaching the latter spring, which had an altitude of 2694 m., we found a solitary young male wild camel grazing; but from the numerous footprints and the abundance of droppings the spring must be visited in summer by large troops of these animals. The wild camel may be regarded as at any rate to some extent a nomad, for in the winter he generally goes down into the deserts of the lowlands, the Desert of Lop and the Desert of Gobi, while in the summer he prefers the mountainous regions of the Kuruk-tagh and northern Tsajdam, and the region of the eastern Astin-tagh. But the habits and migrations of the wild camel are too little known to warrant any reliable conclusions being drawn from the scanty information that we possess. It is indeed possible that different troops range over different grazing-grounds, within which they wander from locality to locality, some troops preferring to keep to the mountains, while others choose the deserts. We also observed traces of wild camels beside the spring at Camp CVI; they appeared to date from the previous summer. I have already thrown out the opinion, that in the region of Basch-jol and Usun-schor the wild camel does not go farther south than to the more open glens of the Astin-tagh; and one of my men declared that, though he had indeed once seen camel-tracks at Usun-schor, he had never seen them so far west as the Ilve-tschimen. Here in the east however they reach as far south as the northern foot of the Akato-tagh, the country being more desert-like and more remote from human settlements. Nor do hunters seem to frequent this region very much; at any rate I failed to find a single wild yak or wild camel hunter who had ever visited this part of northern Tibet. I am not therefore in a position to give any definite information about the range of the wild camel in northern Tsajdam; but I think it is not improbable that these light-footed animals, which possess a marvellous knowledge of the situation of springs and grazing-grounds, do extend their migrations a good distance into the uninhabited parts of Tsajdam. Nevertheless I believe that, in the course of my travels in the interior of Central Asia, I have touched most of the localities within the range and distribution of the wild camel. The accompanying sketch-map (Pl. 2) embodies the results of my observations, and at the same time it will serve to supplement what Prof. Leche says in his section

of this work. The map shows that the wild camel frequents principally the following parts of Innermost Asia — (1) the region in which the Kerija-darja dies away in the desert; (2) the entire southern foot of the Kuruk-tagh; (3) the southern half of the swelling between the Tschöl-tagh and the Kuruk-tagh; (4) the desert between the Kuruk-tagh and the Astin-tagh; (5) the desert north of the Anambaruin-ula; (6) the whole of the eastern Astin-tagh; and (7) the border region between the kakir of Usun-schor and northern Tsajdam. The native hunters are said to have observed that the wild camel, in its wanderings from the desert to the mountains and from the mountains to the desert, makes use of only the following transverse glens in the Astin-tagh—Tschokola, Satschkan, Japkaklik, Mus-saj, Tasch-köl, and Hun-tschan; the reason no doubt being that these glens are broader and opener than the others, and the camels consequently feel themselves more secure against ambushes. But from what I have stated above it will be plain, that a map of the localities in which the wild camel really does resort would be different in summer from what it would be in winter.

One of my men, a hunter from Lop, told me that the wild camel is not so much sought after now since there is less demand for the skin. Formerly a skin would fetch 2 liang in Chinese silver, but now only one, whereas the raw hide of the wild yak is worth 3 liang, and the dressed hide 5 liang. That this region really was unknown to my native servants was proved by the fact that a couple of them considered they had made an important discovery, and resolved to return there in the following summer in order to hunt the wild camel.

With regard to the old road, it is very probable that it did touch this spring, and indeed in the country to the north-east of it we shortly afterwards discovered its continuation. On Dr. G. Wegener's map, »Übersicht des Kwen-lun Gebirges,»\* we find entered »einige wichtige chinesische Strassenzüge», and amongst them, in precisely this region that we are considering, a road which runs from Sa-tschou and the district of Usun-schor, though it is marked by a sign of interrogation. It is however beyond all question that such a road really did exist, although it was a Mongol rather than a Chinese road. I shall revert to its further continuation presently.

Generally the geography of Tsajdam is but little known. While the south-eastern part of this elliptical basin has been visited by several travellers, such as Prschevalskij, Kosloff, Carey, Rockhill and myself, its north-western part has remained quite unknown, and is so still, with the exception of the part that I have just described. With regard to the central parts, only one expedition so far as I know, namely that of Carey and Dalgleish, has ever penetrated across Tsajdam. That expedition started from Hadschar on the Batughantu-gol and travelled north-east to the region of Machaj, which was reached after an eight days' march. The locality in which the Batughantu-gol dies away in the central part of the basin is marked on the map, »Bed of caked salt», and north-east of it is a strip of »sand hills», a couple of days across; to the south-west of Hadschar-tsacha there are also »sand mounds». Thus in this part of the interior of Tsajdam there exists a belt of

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\* In *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, vol. XXVI, Pl 6.

actual drift-sand desert. The country between Carey's route and the route which I followed is unknown; it is an immense region, fully one-half of the area of all Tsajdam. We may assume that this region consists of deserts of schor, drift-sand, and salt in alternate zones, and that it would be dangerous to cross it without carrying water.



Fig. 241. A SHORT HALT.

The more noteworthy features of a panorama which I sketched from Camp CVII, are as follows — from N.  $80^{\circ}$  E. to S.  $53^{\circ}$  E. stretches an open, flat country between the extreme outliers of the two mountain systems, the Astin-tagh and the Akato-tagh. In the latter direction the Akato-tagh is extremely low, appearing only as a barely noticeable elevation, which died away in ethereal shades. To the N.  $54^{\circ}$  E. appeared the entrance to a latitudinal valley running in between two of the parallel chains of the Astin-tagh, and it was in that direction we marched the whole of the following day. To the S.  $18^{\circ}$  E. we perceived a minor swelling of the Akato-tagh, melting away in the haze of the far off distance. From that point and farther west the Akato is like a continuous ridge, with noticeable swellings in the S.  $25^{\circ}$  W. and S.  $40^{\circ}$  W. In the S.  $71^{\circ}$  W. rose the culminating point of that part of the Akato-tagh which was then nearest to us. In the S.  $84^{\circ}$  W. we perceived the same part of the range which we had observed from Julghun-dung lying N.  $22^{\circ}$  W. Yet another ridge of the Akato-tagh was visible to the N.  $85^{\circ}$  W. All these contiguous crests of the Akato-tagh system appeared, from the point whence we observed them, to run very decidedly from the north-west to the south-east, as we indeed found to be the case with the main range and the minor range lying to the north-east of it. All the mountains that may be regarded as belonging to the Akato system terminate in the N.  $78^{\circ}$  W., and north of the most northerly offshoot there is an open latitudinal valley connected with the kakir of Usun-schor.

December 24th. The depression in which we found the spring, the ice-sheets, and the vegetation is flat and open, and bordered on the north-west, north, and south-east by clay terraces; where ice and vegetation fail, its bottom consists of the usual schor, dry and hard. We travelled along it towards the east, the vegetation thinning and decreasing as we advanced. The clay terraces on both sides of the depression were here frequently broken, so that they resembled walls, domes, and long rows of benches (fig. 242). When the depression narrows and finally ceases, it is succeeded by the rough tiring schor, which appeared to stretch southwards for as far as we were able to see, at any rate this was so immediately south of our route, and it was dotted over with isolated clay hills like *jardangs*, but of insignificant dimensions. By inclining towards the north-east we at length succeeded in getting out of that formation, and entered upon hard *saj* strewn with gravel. This ascended slowly towards a swelling of the surface, which swept up at its eastern end into a ridge of crescentic shape, with its concave side looking south. From the top of



Fig. 242.



Fig. 243.

this swelling we perceived to the north yet another depression, much deeper and more energetically hollowed out than the former one, at any rate it was relatively deeper (fig. 243). Perhaps these two depressions are connected together, although from our line of march we saw no point of contact; if there is any such it must lie to the west, where the *saj* swelling comes to an end. This second depression is that of a very broad river-bed or basin, which widens out yet more towards the east. Here again we found any quantity of *kamisch*, but no *tamarisks*. A couple of ice-sheets pointed to the existence of a spring. We went down a steep brae into the bottom of the depression; this, which was flat and level, we crossed over diagonally. Here there were astounding quantities of wild camel droppings: that region must be the wild camels' *El Dorado*. Upon reaching the end of the *kamisch* we climbed up the northern escarpment of the depression and found it far lower and less accentuated than the southern scarp. The depression however continued, though without either springs or vegetation, towards the east-north-east; that is to say, the escarpment which is situated at the northern foot of the little detached mountain seemed to run in a wavy line towards the east-north-east; but the opposite or northern escarpment, which subsequently accompanied us immediately on the right, runs towards the north-east. The bottom of the depression is as level as a table-top and consists of dark brown schor, from which detached hills rise at intervals. The northern escarpment is pierced at frequent intervals by watercourses, which issue out of the southern

transverse glens of the Astin-tagh. These channels are generally pretty broad, though seldom more than a foot deep; their margins however are distinctly defined. All of them run towards the south-east or south-south-east and terminate in the large depression already described, which indeed presents an extraordinary resemblance to a desiccated lake. It is also probable that, if the downfall should happen to be especially plentiful in the Astin-tagh, a temporary lake does actually gather there. At all events this depression forms a characteristic feature at the southern foot of the Astin-tagh, constituting a self-contained drainage-basin independent of the great depression of Tsajdam to the south-east, though probably this depression itself is divided into a number of similar separate and independent basins. The deepest points in our depression were those in which the springs gush out, at Camp CVII and on

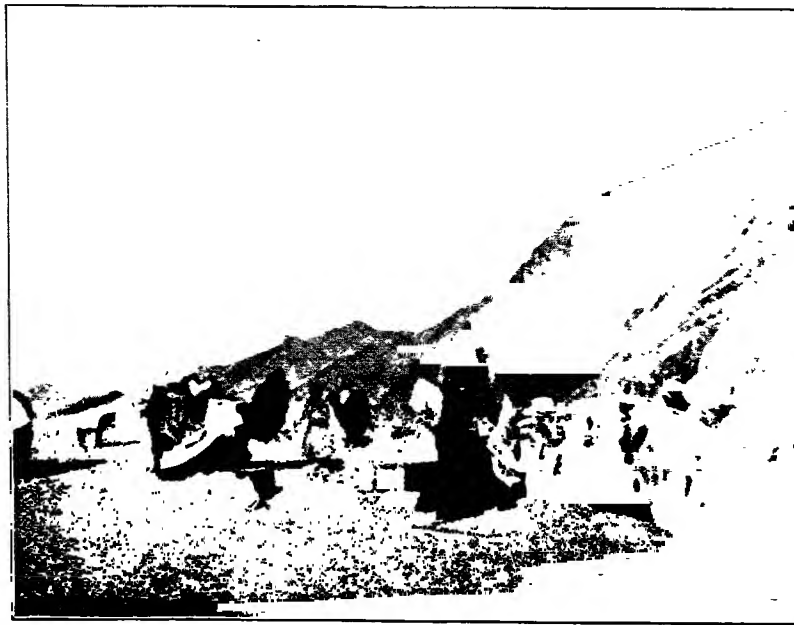


Fig. 244. CAMPING AT THE FOOT OF ASTIN-TAGH.

the north side of the little detached mountain. The morphological relations are here more complicated than they are in the Tschimen valley. We have seen that Schor köl, Kala-köl, and Usun-schor form three self-contained basins. On the east of the last-named we found also that all the eroded watercourses run down towards the east. Between them and the Usun-schor there is therefore a swelling of the ground imperceptible to the eye. The watercourses running east gather into a main channel; but with regard to this last we were unable to make out whether it possesses its own self-contained drainage-basin or whether it does not possibly form the upper course of one of the many channels which we crossed over between Camp CV and Camp CVI. All those channels gather into a main watercourse at the northern foot of the Akato-tagh, and appear to possess their own terminal lake, almost always dry. Between this system and the depression in which we formed Camp CVII there exists an elevation of the surface, however slight. What the great depression is



like to the east I am unable to say, because we now marched away from it. Its sharp-cut boundary in those quarters where we did become acquainted with it renders it conceivable, that in the east also it is equally fenced in by escarpments and does not possess any outlet towards Tsajdam. The escarpment which borders it on the south becomes lost to sight far away in the east, while that which borders it on the north grows both lower and less distinct, for it is in part masked by the long gravelly scree that slopes away down from the central parts of the depression, without any intervening step or terrace.



Fig. 245. THE SAME.

We slowly approached the foot of the mountains, the watercourses from which were now all directed towards the south, so that they converge upon the central parts of the depression. From that side the Astin-tagh presents the appearance of a rather low, desolate, rugged range, pierced at intervals by transverse glens. I entered the compass-bearings of its successive peaks on my map.

Meanwhile the surface ascended slowly in the direction in which we were travelling, that is towards the north-east, and at length we reached the end of the latitudinal valley of the Astin-tagh system, after it had been all day in sight. Camp CVIII (alt. 2860 m.) was pitched in the end of the valley, on hard, gravelly saj, in a region totally destitute of both animal and vegetable life. Both north and south of the camp we had a small detached bluff of the southernmost chain of the Astin-tagh. On the slope of the northern chain, which was quite insignificant, we perceived the remains of a stone wall, probably that of some old *karaul*, or 'watch-house', on the former road. The condition of the ruins showed that they had been deserted a very long time. The bluff on the south of the camp was rather larger, and cleft in two by a transverse glen.

All day we had followed the ancient road, and it was for the most part easy to trace because of the numerous cairns of stones, often pretty big, built preferably on the high terraces and hills. Sometimes we counted as many as 18 separate tracks running side by side, showing that large caravans with a broad front had used to march that way. The very fact of the road being so broad seems to indicate that it was used by large herds of cattle, for those animals are wont to travel in dense masses. In this region too the road appeared to have been more diligently used than where we first came into contact with it. Probably it has split into one or more branches. One of my men, Tokta Ahun from Abdal, who had several times travelled to Anambaruin-gol, had almost always made use of a pass in the Astin-tagh called Kara-davan; this must be situated somewhere to the north or north-west of Camp CVIII. In the neighbourhood of that pass there are, he said, good grazing-grounds, numerous signs going to show that there the Mongols used formerly to pasture their flocks. There is also a story, though it sounds not very probable, that, in the time of Jakub Bek, Mongol shepherds from Särtäng and the Anambar district, whilst feeding their flocks at Kara-davan, were fallen upon and slain by hunters from Tschertschen, who seized their property, though it was again taken from them by Nias Hakim Bek of Chotan. This is however stated as the reason why the Mongols ceased to visit the region of Kara-davan, namely their fear of the Mussulmans. My informant even went so far as to say that the attack was made 26 years ago, or in 1874. If this story is true, the old road will have divided at the spring of Camp CVII, one branch proceeding thence north of the Akato-tagh to Usun-schor and another east of the Akato-tagh to the Ghas-köl and Tschimen. Another branch must have struck off at one of these two springs to make for Kara-davan; though it is not easy to form any definite opinion with regard to this. This old road may of course have been in use for centuries; the several tracks or deep hollows seem to point to a very considerable amount of traffic, and hollows such as these are would be preserved for a very long time in a country that is so poor in rainfall as this is. On the other hand the wind continues its planing and transporting activity year after year; which would seem to lend support to the view, that this route was in use for a period of not more than twenty or thirty years. It may of course be a pure accident, that the wall of the watch-house is in such a ruinous condition and wears such a look of antiquity. Nevertheless it is strange that the Mongols have not resumed their nomadic migrations to Kara-davan and Tschimen, now that the Chinese have again taken possession of East Turkestan, for under the ægis of the Celestial Empire they might reasonably feel themselves secure. For my own part it seems to me more probable that this means of communication was principally used during the time that the Mongols were settled beside the Kara-koschun and maintained touch with their race kindred farther to the east. And if we go a long way back in time, as far as the period when the old Lop-nor was in existence, this route by way of the mountains and the springs must have possessed a certain degree of importance, and travelling here stage by stage, from spring to spring, must have been preferable to journeying through the perfectly waterless desert regions, as they then were, to the north of the Astin-tagh.

December 25th. The minor watercourses which we crossed over to the east of our camp run out of the Astin-tagh towards the south, breaking by a small transverse glen through the westernmost part of the southern parallel chain. This chain is in the quarter mentioned rather ragged, consisting of several small detached portions. After surmounting a low threshold or saddle in the latitudinal valley (alt. 2918 m.), we perceived to the south a more energetically excavated transverse glen, by which the main drainage channel of the western part of the valley issues. Through this gap or gateway we obtained our last glimpse of the plains of Tsajdam. After that the southern chain of the Astin-tagh forms a connected and continuous crest. From it and from the chain on the north of this latitudinal valley countless tiny brooks flow down into the main watercourse up which we were then travelling. This channel, which is of considerable size, is bordered by rounded marginal terraces two meters high.

Still following the ancient road, we crossed diagonally over the latitudinal valley and so approached the northern chain of the Astin-tagh, after we had adopted a more northerly and finally a north-north-westerly course, crossing on the way over a secondary threshold between two minor free-standing sections of the mountains. And we crossed over yet another similar threshold amongst these scattered groups of heights. From these the eroded watercourses gather from different directions into the main channel of the latitudinal valley. The upper part of this last originates at a minor swelling in the valley itself. The offshoots of the chain closed in more and more. Then, turning our backs upon the latitudinal valley, we began to ascend a transverse glen leading up to a pass at the summit of the northern chain. The pass proved easy of access and had an altitude of 3247 m. The only part that was at all steep was the upper part of the northern declivity. The descending glen runs at first to the north-west, then towards the north-east, and soon issues into a fresh latitudinal valley. To the N. 60° E. we saw distinctly yet two other parallel chains belonging to the system of the Astin-tagh. Hence this system, which we previously found to embrace two parallel chains — I call them the Upper and the Lower Astin-tagh — consist here, where they form the north-east border of the basin of Tsajdam, of not less than four chains, all parallel to each other and running from south-west to north-east. The two middle chains, which are the largest, answer without doubt to the Upper and Lower Astin-tagh, while the chain that comes farthest south may be regarded as a shorter subsidiary range, and so too may the one farthest north. We shall lower down come across the prolongation of this last. The latitudinal valley in which we were marching towards the N. 62° E. is thus the orographical continuation of the latitudinal valley that we traversed diagonally between Basch-kurghan and Basch-jol. Both the Upper and the Lower Astin-tagh, between which we at this time were, give the impression of being relatively low chains, an effect attributable in no slight degree to the considerable altitude of the latitudinal valley itself. This valley is several kilometers broad, and at the points where we first struck it, its bottom was composed of large expanses of barren reddish clay, an indication that it was a small self-contained drainage basin, in which the rain-torrents off the adjacent mountains are wont to gather. On the right we had a distinctly outlined escarpment, gapped by a number of eroded water-

courses. Across the middle of the valley runs a belt of rudimentary dunes. We pitched Camp CIX beside some small detached clay hills. All day the country that we marched through was absolutely sterile, a perfect desert region. The tracks of the wild camel were few and far between, counting old as well as recent. The altitude here was 3104 m.

We observed hard rock in two or three places, but it was weathered to such a degree as to be unrecognisable. At Camp CVIII its dip was  $85^{\circ}$  towards the N.  $35^{\circ}$  W. and at the third secondary pass  $30^{\circ}$  N. The only rock which we found capable of resistance was an excessively hard greenstone, dipping  $64^{\circ}$  towards the S.  $20^{\circ}$  W.

The wind blew very violently all day from the north-east. Possibly the same wind relations obtain here as those that are characteristic of the Desert of Lop. During the next succeeding days too it blew from the north-east, often with annihilating violence. In the eastern Kuruk-tagh I noted north-east storms as occurring in the middle of February. Here in the Astin-tagh they seemed to begin as early as the New Year. The direction of the latitudinal valley is thus especially suitable for this wind, and we found it in a high degree wearying and enervating.

The gale continued until midnight and then abated; but early on the morning of the 26th December a violent tempest sprang up from the north, though it quickly veered round to the east. Quite unexpectedly it brought with it some snow, as fine as flour and yet so thin that it was invisible on the ground except under the lee-ward shelter of the watercourses and ravines. On the mountains however it fell more copiously, and here and there the slopes gleamed out white from under the masses of cloud by which the crests were all day hid.

There exists a great difference between these mountain crests and those which we subsequently became acquainted with on the high plateau of Tibet. Here in the Astin-tagh the mountains, like those in the Kuruk-tagh, are indeed severely weathered, but they always consist, from base to summit, of hard rock, bare and barren, most frequently piled up in eccentric rugged masses, denticulated, pinnacled crests and peaks. On the Tibetan plateau on the other hand most of the ranges are distinguished for their rounded outlines and soft consistency, and their striking poverty in hard rock, which in the best cases only crops out near the summits. Here too disintegration has been to a remarkable extent operative. This gives rise to the great morphological difference, that in the former region, the Astin-tagh and the Kuruk-tagh, the products of disintegration are almost always carried away by the wind and so disappear; no matter how powerful or how active the disintegration may be, none of the loosened material ever succeeds either in gathering amongst the mountains or in accumulating at their foot. The climate is so arid, and precipitation so extremely rare, that the fine powdery material falls a helpless prey to the winds. On the other hand the precipitation on the Tibetan plateau is so copious and so uniformly distributed, that it is able to keep the loosened material *in situ* and causes it to heap itself up in rounded masses on the flanks of the mountains that are its primitive source of origin, these projecting in great part like skeletons from the midst of their own ruins. The violent wind which also prevails there is unable to effect anything against the binding power of the moisture.

Add to this the roots of the grass, which in some quarters likewise serve to retain the disintegrated material; whereas the arid mountains are destitute of this means of assistance. Of course there exist intermediate forms between these two extremes, which cannot very well escape the observation of one travelling across

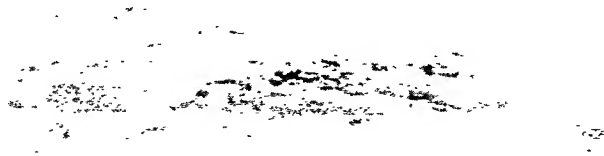


Fig. 246. SOME VIEWS FROM THE OPEN ASTIN-TAGH VALLEY.

northern Tibet from north to south. Indeed similar transitional forms may be observed in one and the same range, *e. g.* in the Astin-tagh itself, for in its more westerly parts we have found that there exist vegetation, and even water, as for example at Tatlik-bulak and Basch-jol, but here the range is both higher and more

massive. And as we now proceed farther east we shall find a similar change for the better taking place.

December 26th. This and the next following stages were remarkable for their monotony, for we now directed our march towards the east-north-east between

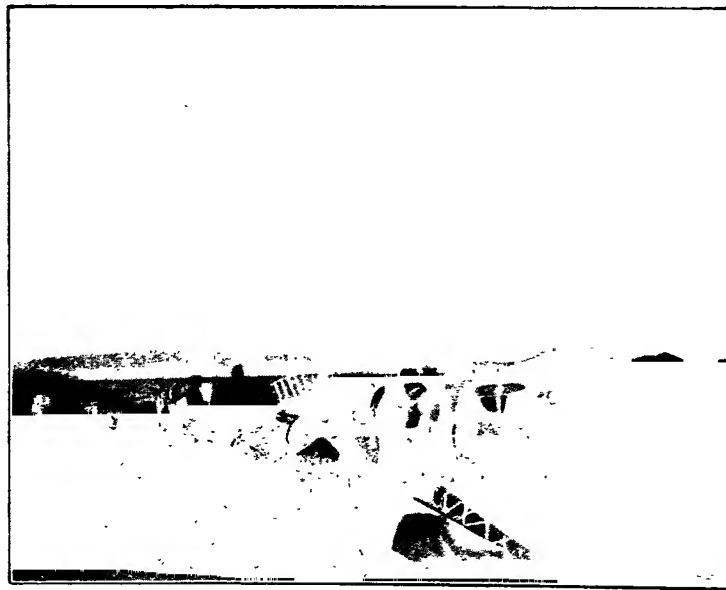
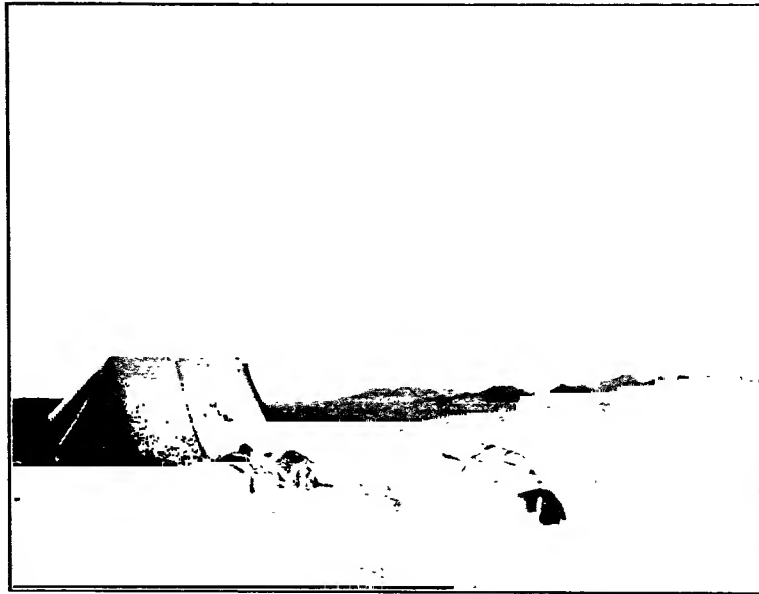


Fig. 247. SOME VIEWS FROM THE OPEN ASTIN-TAGH VALLEY.

the two main chains of the Astin-tagh, and the changes which the landscape underwent in the great latitudinal valley were inconsiderable. The characteristic feature of this valley is that it does not possess any decided fall in either the one direction or the other, but is cut up into a series of self-contained basins, each serving

as the gathering-ground of the brooks that run down off the adjacent mountains. Outside the lower end of each larger transverse glen there is a scree of sedimentary matter. These are however very flat, and their lower edges generally reach all the way down to the central part of the basin, which is occupied by an expanse of yellow clay, perfectly flat and fairly hard, as well as dry and barren, often cracked into polygonal masses and drawn out in the direction of the long axis of the valley. During the course of this day's march we crossed over seven of these minor basins, three of them being large, the others very small, and decreasing in area from west to east. They made an excellent road for marching on, being as level and as easy as the asphalt-paved streets of the capitals of Europe. Across these level expanses it is plain that the old road also led, although in this particular region all traces of it are of course obliterated; but a cairn of stones crowns every heap of gravel and also each small dividing-ridge between the several basins.



Fig. 248. SOME VIEWS FROM THE OPEN ASTIN-TAGH VALLEY.

But though the great morphological features of this latitudinal valley forcibly recall the latitudinal valleys of Tibet, the climatic differences give rise to differences between the basins corresponding to differences between the mountain-ranges themselves. For while the self-contained basins of Tibet generally possess a salt lake in the middle, into which brooks and streams of greater or less magnitude gather, often from very considerable distances, these self-contained basins of the Astin-tagh are very small in area, and it is extremely seldom that their central parts receive any water at all, only in fact after copious rain. These 'terminal lakes', or more accurately sedimentary plains, are therefore almost always dry, or are covered by only a very thin sheet of water, perhaps for only one or it may be two days in the year; and yet it is conceivable that there are years in which they do not even receive any water at all.

The accompanying illustration (fig. 249) will serve to give an idea of the central part of one of these basins, in which gravelly screes are protruded from the transverse glens on both the east side and the west. But, as in most of the other basins crossed over during the course of the day's march, it is situated nearer to the northern than to the southern range. The screes, which generally get the lion's share of the scanty supply of moisture, bear a sprinkling of teresken plants, and these increased in quantity the farther we advanced towards the east. The thresholds which separate the several smaller basins are of the very slightest relative altitude.



Fig. 249. VERTICAL SECTION OF VALLEY WITH SEDIMENTARY PLAIN IN THE MIDDLE.

The mountain-ranges which fence in the great valley are fairly equivalent in point of magnitude and regularity; but while the northern chain is more bulky, and rounded like a loaf, tapering peaks of no great height rise above the general level of the southern chain. The most conspicuous of these is the peak *T*; it was in sight all day. At length a change took place, at least for a time, in the configuration of the bottom of the valley; for it showed for some distance a distinct rise towards the north-east, and we approached a larger threshold, the altitude of which was 3223 m., while on the other side of it the surface fell away again for as far as we were able to see. And yet even this threshold, which lies amongst low hills and broken ground, is so broad and flat, that it is almost impossible to make out where the actual dividing-line is situated. At first too the descent from the pass is not obvious, but gradually it becomes so, as one crosses over the successive watercourses running out north-eastwards from the southern chain. These reach in some cases a depth of 2 m., and join a main stream situated quite close to the foot of the northern range.

During the second half of the day's march the principal valley grew somewhat irregular. At this part the northern chain seemed to consist of two ranges: the one next us on our left composed of little more than hills, and behind it the chain proper. In the southern chain there appeared to be a decided breach, namely a large transverse glen with a stream running towards the south, that is towards Tsajdam. The main channel of the latitudinal valley still appeared to continue on towards the east-north-east.

Camp CX (alt. 3092 m.) was made a short distance north-east of the pass, in a gravelly locality abounding in teresken plants and with several expanses of flat sediment; but water was wanting. Of wild animals we saw only a solitary raven, besides the track of an antelope and of a wild camel.

According to my topographical measurements, the Tasch-köl ought to have been a good day's journey to the north-west, and as according to the statements of my men the pass of Kara-davan — which is situated in a range running from west-south-west to east-north-east — lies about 10 km. to the east-north-east of the



Tasch-köl, it follows that this pass ought to be somewhere to the north-north-west. The region which we had now reached was quite unknown to my men, for when travelling to Anambar themselves, they are wont to follow a mountain-track farther to the north, a track that we were soon to strike into.

On the morning of the 27th December it was snowing, and the ground was covered with a thin sheet, inspiring in us the hope that we should be able to water our horses, for it was forty-eight hours since they had tasted a drop. But even before noon the snow had all melted, with the exception of small strips remaining in crevices and ravines facing the north. If we may judge from the slight and infrequent falls of snow which we observed that winter in the Astin-tagh, it is probable that the winter precipitation is too small to allow of the snow accumulating in sufficient quantity to give rise to torrents of any magnitude in the spring. The snow did not remain a single day, and even though it does chance on any occasion to fall in greater abundance, it is fair to assume that it disappears without giving rise to running streams. In other words such watercourses as do exist owe their origin exclusively to chance rains, which, to judge by the relations of the southern part of the country of Lop, will fall principally in the spring and early summer.

This day too we followed the ancient road, though its landmarks were now growing fewer. Both road and heaps of stones kept to the more elevated parts, where they are safe from the mountain torrents; hence there were no signs of the former across the detritus screes. The northern chain of the Astin-tagh, to which we were now quite close, had decreased sensibly in altitude, but the southern chain still maintained a noteworthy elevation, with steep, wild, deeply incised transverse glens, directed towards the north, and generally fenced in by dark precipitous walls of rock. A little way below Camp CX the main watercourse of the valley broke up into a countless number of shallow, undecided branches, which we successively crossed over as we approached the mountains on the north side of the valley.

But now a change took place in the extraordinarily regular features of the landscape. For two days we had marched almost in a straight line towards the east-north-east between the same two parallel ranges. Now however there appeared in the middle of the latitudinal valley a conspicuous butte, which, though not very high, was of considerable area, having at its northern foot, immediately on the right of our line of march, a yellowish-red expanse of clay, the gathering-ground of the main stream of the valley and of all the torrents that issue out of the transverse glens of the entire region. But from our route we were unable to see sufficient of the country to obtain a perfectly clear conception of its relief. The most important feature in the morphology of the region is however a conspicuous gap in the south-east, that is to say a transverse glen, piercing the southern chain, and containing a clearly marked, sharp-cut watercourse. And yet it is unlikely that the clay expanse just alluded to really does constitute a self-contained basin; it is more probable that it is only a flat expansion of the main stream of the valley, and that to the east of the butte it finds an outlet through the gap I have mentioned: this does indeed receive another main stream coming from the east-north-east, from between two of the parallel ranges of the Astin-tagh. Hence from this point the

chain which we had hitherto had on our right became double, in the same way as the chain on the north. In other words the Astin-tagh system is by no means of so simple a character as it is represented on the map of the Russian General Staff, which shows only a single range, crowned at intervals with immense accumulations of perpetual snow, though of this I unfortunately failed to come across the smallest trace. Meanwhile our old friend, the chain on the right, continued in a straight line towards the east-north-east, the only breach in it being the gap which I have mentioned; but on the east of that gap it towered up in imposing masses, loftier than any other part of the system in that region. The second and smaller parallel chain may be regarded as dividing our latitudinal valley lengthwise, in that it begins at



Fig. 250. A SNOW-DRIFT NOT FAR FROM CAMP CXI.

the butte and forms its east-north-eastern continuation. The little pass which we were now making for is situated between the western extremity of this chain and the chain which borders the latitudinal valley on the north. Towards it runs the ancient road, bearing north-north-east from the clay expanse. The country we had to traverse on the way was both hilly and very broken, being furrowed by countless ravines, and here we did at length find snow, heaped up in drifts by the wind. Here too there was an abundance of teresken bushes. All the eroded watercourses which issue from this part of the northern chain of the Astin-tagh appear to make for the great gap, through which we at length caught glimpses of the lowlands beyond, namely the wide-spread plains of Tsajdam. So far as we were able to make out, the stream through the gap inclined more and more to the south and south-south-west.

On the other side of the little pass (alt. 2978 m.) the surface slopes farther towards the north-east, and we soon found ourselves in a minor self-contained basin,

triangular in shape and more sharply defined than usual. In its western part we formed Camp CXI at an altitude of 2910 m. In the course of the afternoon the snow came down faster and faster. Here we observed traces of kulans, both old and recent, though none of the wild camel.

December 29th. I will proceed to finish my detailed description before going on to give a general review of the Astin-tagh system as a whole. From Camp CXI I made a trip to the spring of Lap-chi-tschen, situated 6 km. to the north-north-east. First I bore to the north-north-west, making for quite an insignificant pass, or threshold (alt. 2915 m.), that borders our self-contained basin on the north. The pass was indeed very little higher than our camp. It consisted of a low flat

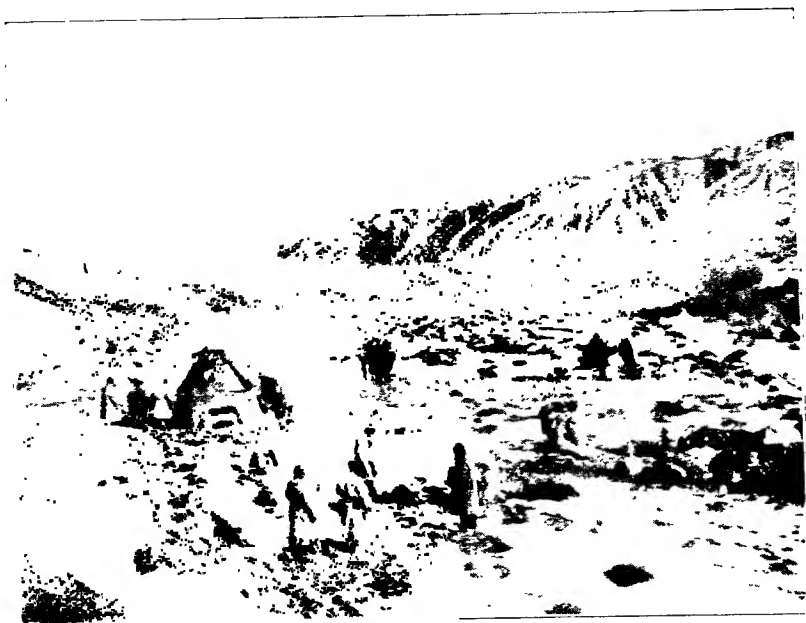


Fig. 251. CAMP CXI.

swelling, with slight elevations on both sides, and lying among soft earth on which the teresken bushes were growing plentifully. On the northern side the declivity is more pronounced and the descending glen gradually curves round towards the north-north-west, the north, and the north-north-east, without making any sharp bends. While from the pass on its south side only one insignificant torrent of a temporary character runs down towards the middle of the self-contained basin, the northern glen is traversed by a watercourse that deepens as it descends, picking up as it goes from both sides, but especially from the left or west, various side-glens, most of which start from the summit of that chain of the Astin-tagh in which the flat pass is situated. One of these side-glens is especially large, broad, and choked with gravel; this may be regarded as the principal glen of Lap-schi-tschen. The side-glens that come in from the right are however quite insignificant. A short distance below the outlet of the large side-glen, we came across a sheet of ice, in the middle of the main glen, here about 100 m. broad. Opposite to it yet another

glen issues from the left; it originates in a more imposing part of the main range, visible to the N. 80° W. Just before joining the main glen, this side-glen contracts to a narrow passage, and about a dozen paces up it the spring gushes out in the very bottom of the glen itself. The water, which had a temperature of + 3.5°, was perfectly limpid, and had a very slight saline flavour; the areometer gave a sp. gr. of 1.0032. At the point where it gushes out, the spring forms a miniature basin, the water in which was not frozen, though it was frozen only a few meters below it, and finally in the middle of the main glen it formed a sheet of ice 30 m. broad and 80 m. long, and about 5 cm. thick. Under it there was a layer of water. The ice had formed in successive layers one upon the other, while between them were sometimes thin sheets of water; the reason these had not frozen was probably because they had absorbed the salts previously precipitated. The sheet of ice goes on growing bigger during the winter in the same manner as the sheets do at the springs of Altmisch-bulak, and probably survive for a longer period in the spring than the latter do. Around this spring were growing bushes (*balghun* and *bagh-ana*), some grass, and a sprinkling of teresken. The altitude was 2770 m.

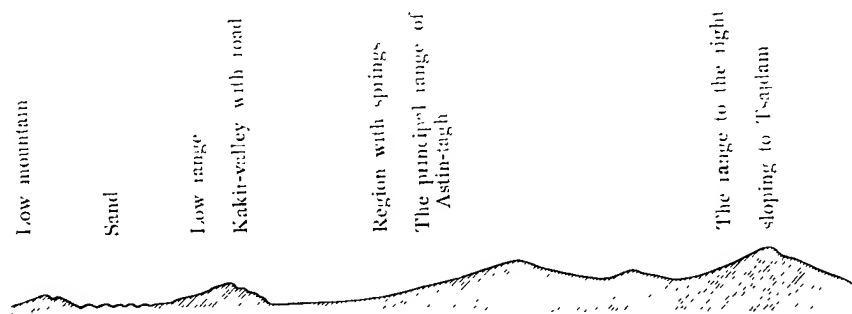


Fig. 252.

Now small and insignificant though the two passes are that lay south and north of Camp CXI, they are nevertheless possessed of great orographical and hydrographical importance. The former directs the water to the basin of Tsajdam, the latter directs it towards the Desert of Gobi, while between the two stretches a flat self-contained basin. It seems probable that the crest with the northern pass corresponds to the Lower Astin-tagh at Tatlik-bulak and Basch-kurghan, and that the range with the transverse glen answers to the Upper Astin-tagh at Basch-jol, although it is doubtful whether they form the immediate continuations of the chains that we crossed over farther west. It is almost more probable that, owing to the great distance between Lap-schi-tschen and Tatlik-bulak, there are one or more interruptions in their continuity. One difference at the points named is that at Tatlik-bulak the Lower Astin-tagh is divided by a transverse glen, while the Upper Astin-tagh had to be crossed by a pass in the summit above Basch-jol. At Lap-schi-tschen on the contrary it is the Upper chain that is pierced by a transverse glen, whereas the Lower chain is not.

At about 6 or 7 km. north-east of the spring we perceived a large mountain-mass: this belongs, I was told, to a special range of foothills, which stretch thence

westwards. Between them and the Lower Astin-tagh intervenes a broad latitudinal valley or kakir. Thus in this locality there are four parallel chains of the Astin-tagh, unless indeed the chain which borders our self-contained basin on the south is not rather a branch of the great southern range that is broken through, though this is I think scarcely likely.

From the spring of Lap-schi-tschen our main valley stretches straight towards the N.  $48^{\circ}$  E.; at any rate the bends it makes round the projecting parts of the mountains are quite small. In the same direction we saw the chain of foothills already alluded to. It appeared to bar the valley; but the latter really pierces it, while its watercourse continues towards the north, and finally disappears in the sandy desert. On this side of the range of foothills, that is to say in the broad Kakir valley, the transverse glen of the Lap-schi-tschen is said to unite with another glen coming from the spring of Ku-schui-cha, and it was in the end of this latter that we formed Camp CXII. How far the conjoint watercourse, formed by the confluence of these two glens, is able to penetrate towards the north my men did not know; but to judge by the relations that exist at Anambar, it cannot be very far. The men were however of opinion, that it was a good day's journey to the beginning of the drift-sand desert, and they knew for certain, that in the sandy desert there actually is a *partscha-tagh*, or small detached mountain, or butte. I doubt this statement however, and consider it more likely that there too, as farther east (see vol. II p. 471 ff), there is an expanse of steppe at the northern foot of the Astin-tagh, that this zone of steppe is bordered on the north by stretches of low hills, forming the westward continuations of the mountains which we crossed over in the Desert of Gobi, and that the actual drift-sand desert only begins on the north side of these small desert mountains. Full certainty upon these points can only be gained after the Astin-tagh and the desert to the north of it have been further explored. Littledale's map contains too few details to be capable of throwing any light upon the matter.

The spring of Toghrak-bulak is said to lie to the N.  $70^{\circ}$  W. from Lap-schi-tschen; from it it is reckoned a day's journey to the spring of Ku-schui-cha, the greater part of the road traversing the broad Kakir valley. The only water accessible is however that of the wells of Ku-schui-cha, and Lap-schi-tschen up in the mountains. I was told that there was formerly one spring in the Kakir valley, surrounded by kamisch and marked by a solitary poplar; but this subsequently dried up completely.

Close beside the little pass and in the sides of the glen running north the rock consisted of a hard green schist, close-grained and generally severely weathered; it dipped at first  $26^{\circ}$  towards the S.  $25^{\circ}$  E., then  $82^{\circ}$  towards the S.  $60^{\circ}$  W., and finally  $89^{\circ}$  towards the S.  $40^{\circ}$  E. Near to the spring we had red granite, though it did not extend very far, for the mountains which we saw at some distance to the north again exhibited a green tinge.

## CHAPTER XX.

### THE EASTERN ASTIN-TAGH.

On 30th December there was a very violent gale from the south-south-west, though the sky was perfectly clear. We still continued to travel towards the N.  $60^{\circ}$  E., traversing the self-contained basin endwise, and having on our right, close to the foot of the mountains, the lowest part of the valley, generally indicated by a flat expanse of clay. During the course of the day the mountains that shut in the valley on both sides underwent a great change. The range which I have considered to be the eastward continuation of the Lower Astin-tagh swells out considerably to the north of the self-contained basin and sends down towards it several minor glens: farther east however it grows increasingly lower, and it turned out to be pierced by transverse glens in no fewer than five separate places. From the bottom



Fig. 253. IN THE MIDDLE, THE PIERCED RANGE.

of the basin the ground rises very slowly towards the pass on the east, an insignificant saddle or swelling (alt., 2930 m.) in the latitudinal valley. After that we kept on the whole at about the same level all the time, that is to say, each separate drainage-area was parted from its neighbours on both east and west by a low threshold; and these naturally occur at the lowest levels. The range which we now had on our right began at the small butte north-west of the transverse glen that runs down towards Tsajdam and after that borders our self-contained basin on the south. This range increases in altitude towards the east-north-east, and very soon assumed the character of the main range of the Astin-tagh system. From our route we were unable to form any conception as to the nature of its connection with the range which we had previously had on our right hand; though it is probable that it dies away towards the east-north-east and is replaced by the range that we then had on our right. But for a short distance, as I have already said, they appeared to run parallel to one another, the great transverse glen that dips into the Tsajdam

basin being met by a latitudinal valley from the east. The orographical structure in this region is thus rather peculiar, for two parallel ranges, with a lofty latitudinal valley between them, take turns about in functioning as the range that is pierced. First, the range on the right is breached so as to admit of drainage taking place to Tsajdam, and shortly after that another breach is made in the left-hand range in order to allow the water access to the Desert of Gobi. Thus it is first the left-hand range, and after that the right-hand range, which acts as the definitive water-divide.

Of the five transverse glens on the left the first is the most accentuated, being deeply trenched between bare black schists. It is stated to belong to the glen of Lap-schi-tschen, that is to say it enters its lowest part from the right down near the Kakir valley; this last appears to narrow towards the east and finally to come to an end. The other four transverse glens, on the other hand, have their upper parts directed towards the N. 20° W., and are said to belong to the glen of Ku-schui-cha, entering it from the left. This latter glen is joined on the right by none but insignificant »moribund« side-glens, which issue out of the lower-lying mountain regions, whereas the

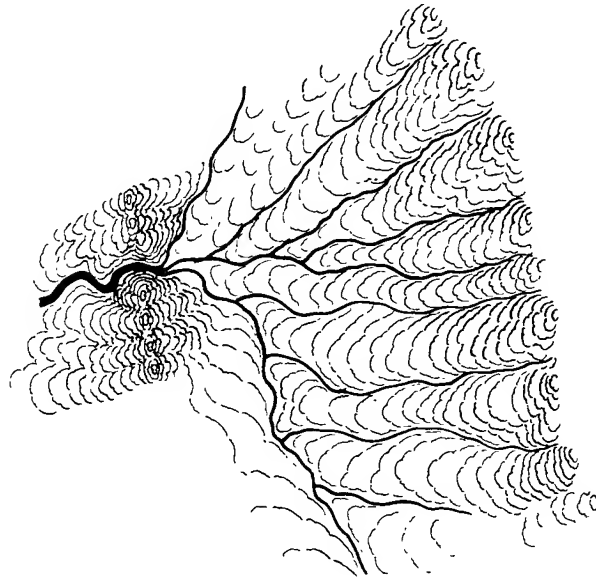


Fig. 254. A VALLEY BREAKING THROUGH THE RANGE.

side-glens that join it on the left originate under the main crest and water-divide of the Astin-tagh. In consequence of this the lowest part of the latitudinal valley runs along the southern foot of the range that is pierced through, and from it the country ascends rather energetically towards the northern foot of the main range. The two annexed illustrations (fig. 253 and 254) will make the situation clear. Seen from our latitudinal valley, which in this locality was quite narrow, not more than a couple of hundred meters across, though previously its breadth had been one to two kilometers — seen from our valley, the pierced range appeared to be infinitely small as compared with the main range, the vast rocky masses of which dominate the scene. The consummating crest of the former does not rise particularly far above the bottom of the latitudinal valley. On the other hand the chain of foot-hills which we had previously seen from the spring of Lap-schi-tschen now showed itself at the opening of each transverse glen on the north; it turned out to be of considerable size, a wild craggy, denticulated, jagged crest, with bare precipitous flanks. It makes an incomparably more imposing impression than the pierced chain, which notwithstanding forms a higher step in the swelling of the Astin-tagh system. This system constitutes a dividing-wall between the Desert of Gobi and the basin of Tsajdam, lying at a considerably higher altitude. The peaks of even the lower range appeared to be a good deal higher than the not very conspicuous culminating emi-

nences of the pierced range. Another difference exists in the fact that the range of foothills appeared to consist of naked rock, whereas the pierced range is built up of friable disintegration products, and consequently its outlines are more rounded. The only spots in which solid rock is visible in the latter are in the deep-cut gorges of the transverse glens. All these ranges however still preserved the same direction as heretofore, namely towards the N.  $60^{\circ}$  E.

While the right-hand range continues, mighty and imposing, with outstanding pyramidal peaks, deep gorges, and dark precipitous flanks, the left-hand range practically comes to an end, by breaking up into a multitude of detached hills and peaks, amongst which the higher-lying watercourses of the last of the transverse glens makes its way. Here there was a perceptible fall towards a large open area or expansion of our great latitudinal valley.

A little farther on the spring of Ku-schui-cha (alt., 2669 m.) gushes up between a couple of minor bluffs, and was then encircled by extensive sheets of ice, resembling in the distance a small lake, surrounded by fairly luxuriant fields of kamisch. Properly speaking, there are several springs; the one farthest to the west had perfectly fresh water, while the others were rather salt. The large glen of Ku-schui-cha leads from the vicinity of the springs towards the north-west, having on its right quite an imposing range; this may be regarded as the eastward continuation of the pierced range, which here describes an arc towards the north. Littledale's map of this region is on the whole inadequate; but according to it he appears to have proceeded from the before-mentioned Kakir valley up through the glen of Ku-schui-cha to the spring of the same name; and from that point to Anambaruin-gol (which Littledale incorrectly calls Nan-ambal) his route coincides with mine.

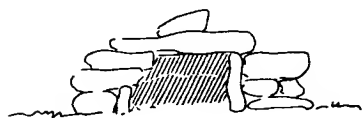


Fig. 255. A FOX-TRAP.

During the course of the day the vegetation in the latitudinal valley increased in luxuriance, until at length the teresken and other scrubby bushes grew as close together as ever they possibly could. Here also there occurred a steppe plant which the natives call *tschaj* = tea), because from it the Tungans are wont to infuse a kind of tea, *tagh-tschaj*, or »mountain-tea». There was also excellent grass in places.

Of faunal life we saw five kulans and a solitary male wild camel; and except these nothing but ravens.

Just above the spring we came upon a couple of *kasghaks*, or »fox-traps», set by the Tungans, who at times use this spring as a base for their hunting-excursions in the neighbourhood. The traps are trenches or oblong stone cists, with a narrow entrance. Inside is a piece of meat to serve for a bait, and when the fox creeps in after it, a large stone falls from a hole in the top and kills him, for the least touch of the meat moves a stick, which brings down the stone through the hole. These *kasghaks* are said to date from early in the seventies, when half Sa-tscheo was inhabited by Tungans, who lived in part by hunting. They used to go up into the mountains and stay there for some time, shooting wild camels and catching foxes. Then, selling the skins in Sa-tscheo, they bought asses, which they afterwards sold at a good profit in Abdal. Perhaps these Tungans also made



use in these journeys of the ancient road so often alluded to above. During this day's march it was again quite distinct, being always indicated by means of cairns of stones, one or two of which were of large size. In the vicinity of our Camp CXI the road appeared to divide, one branch running down to Lap-schi-tschen and the Kakir valley, while the other continued along our latitudinal valley as far as Ku-schui-cha, and so on to Anambaruin-gol.



Fig. 256. THE FOX-TRAP AT KU-SCHUI-CHA.

Near Camp CXI there occurred a species of hard black rock, finely crystalline breaking readily under the hammer, and dipping  $56^{\circ}$  towards the N.  $20^{\circ}$  W. Similar dark-coloured schists appeared to continue all the way after that. At Ku-schui-cha was a smaller mountain-mass, composed of red granite. The plentiful gravel in the latitudinal valley consisted of granite, quartzite, and schists, often in pretty big pieces.

From sunset an exceptionally violent storm raged all night and all the next day, and made the already intense cold almost unbearable.

On 31st December we continued our march down the latitudinal valley, travelling N.  $72^{\circ}$  E. The ground was soft and comfortable to ride over, and was moreover perfectly level, except for a slight rise towards the east-north-east, where there was a little bare swelling at the northern foot of the mountains.

We had an uninterrupted view down the glen of Ku-schui-cha; it appeared to run towards the N.  $60^{\circ}$  W., and then to skirt round the lower big range of foothills on the west. The strip of kamisch soon came to an end, and was succeeded by scrub and grass, growing in small tufts. There the valley widenes out again to 2 or 3 km. The range on the right still continued to be massive and grand, with strongly accentuated relief forms, but without any specially outstanding peaks, its

crest-line running pretty evenly. In places on the flanks were thin strips of snow. On the level ground the snow lay however in far less quantity than the day before, and in fact it soon ceased altogether. The left-hand, northerly range now bore a closer resemblance to a chain of low rounded hills, though nowhere did it exhibit any breach; the eastern limit of the transverse breaches is Ku-schui-cha. The surface of the latitudinal valley consisted of soft earth, with little or no gravel. At first there were no eroded watercourses in this valley, and it was only in the last portion of it that we passed a series of narrow and fairly deep ravines. These gather into a main channel, which clings close to the foot of the southern range and has a west-south-west direction; nevertheless it soon disappears in the ground.



Fig. 257. THE SAME.

On the southern side of the northern range, which here again is somewhat more massive, there occurs a transverse glen known as Ja-ma-tschan. Through it runs a deeply excavated drainage channel, and in its bed, a short distance above its mouth, the spring of Ja-ma-tschan gushes out; it was then completely frozen over, but is said to be nevertheless salt. All the same the sheets of ice were much trampled by kulans, arkharis, and wild yaks. And curiously enough we saw some of the last-named on the northern slopes of the range, although I scarcely expected that these animals would have ventured to visit such a comparatively remote mountainous region. Still they would be less disturbed there in the winter than in the summer.

At the spring (alt., 3024 m.) the rock was the same dark schist as that which I have last described, and its dip was  $78^{\circ}$  towards the N.  $12^{\circ}$  W.

Immediately east of the spring of Ku-schui-cha is a lofty stone pyramid, with a slab bearing an inscription in Chinese script, though whether its object is to proclaim, that the country there belongs to China or to celebrate some wretched

victory over a handful of hunted Tungans, I am unable to say. Here however it may be as well to place on record the incident alluded to, which took place in this valley. In the year 1896 the Tungans of the Si-ning region revolted against the Chinese, but were defeated, and large numbers of them were massacred. A considerable body however fled westwards, and of these people I saw the trail whilst journeying from Tsajdam by way of the Kōkō-nor to Si-ning. Upon approaching Ja-ma-tschan they were met by a Chinese force sent from Sa-tscheo to intercept them. There was a fight, in the course of which several Tungans were killed, and others taken prisoners; they were too ill armed to have any chance of successfully resisting the Chinese. After the prisoners were seized, some 500 of the fugitives,

were cared for by a body of Chinese, who entered into friendly intercourse with them and induced them to lay aside their weapons, besides distributing flour and other provisions amongst the starving, hunted Tungans. Then they were guided to Tscharklik and Abdal, and thence farther to the north, where, on the initiative of the Chinese, they founded the colony of Kara-kum in the neighbourhood of Schinalgha; and at the same time colonists were also settled there from other quarters. Four of the chiefs or more distinguished men of the fugitives were carried to Urumtschi, to be tried, and were there beheaded.



Fig. 259. WASHING IN CAMP AT KAN-AMBAL.

My reason for relating this trifling episode is that it is not likely to find its way into any other chronicle, and because it represents the last westward after-swell of the Tungan revolt. It likewise constitutes a strange isolated wave in the history of the *Völkerwanderungen* of Central Asia, a wave that has passed without leaving any other traces behind it except the little village of Kara-kum. It thus forms intrinsically a remarkable, and at the same time an admirable, example of resignation and tenacity of purpose — a body of several thousand people set off to travel to some unknown region, leave innumerable graves behind them beside the track, are stopped again by armed force, and then, when the last miserable remnant are on the point of perishing of hunger, they find safety in a strange country!



*Lynch, A. B. Lagrange & Westphal.*

ANAMBARUIN-GOL, SOUTHERN SIDE OF THE VALLEY.



January 1st 1901. The morning was perfectly clear, but early in the afternoon the sky clouded, and later on the clouds condensed together. Then the storm burst, and the masses of air poured on through the valleys like veritable cascades.

We still continued to travel towards the east-north-east, and in that direction the surface now sensibly rose. The two ranges which inclose the latitudinal valley still preserved the same characteristics as before, but the range on the right, i. e. the south, still remained incomparably the bigger. The ancient road likewise continued, its course being indicated by numerous cairns of stones; but we perceived no signs of its having been used by recent travellers. The snow again increased in quantity and the thin snow-drifts were generally mantled with a slight layer of drift-dust. Superficially the snow was hard and tenacious, the crust being strong enough to bear us; indeed in some places it was converted into ice. For the greater part of the day we followed the principal watercourse of the latitudinal valley, which was now bordered on the north by a more or less continuous escarpment. The watercourse runs quite close to the base of the range on the south, so that the deepest part of the valley lies on that side, though previous to that it lay in the northern half, that is where the transverse glens cut their way through it. We marched in fact so close to the southern range that every now and again we had to skirt round its more protuberant bluffs and promontories. The northern range increases rather in height towards the east. At length the latitudinal valley grew narrower. Keeping on to the north-east and north-north-east, we climbed up to its eastern pass, a low and easy saddle, situated close under the foot of the northern range. Just south of it there appeared to be a second similar pass, though lower; but it probably is on a less convenient and less suitable road to Anambaruin-gol.

From this pass, which has an altitude of 3494 m. and is crowned by a pyramid of stones, we saw the «Anembarula», which Przhevalskij discovered, though a more correct designation is Anambar- or Anambaruin-ula. On the side next us it had some smaller snowfields. Between us and it a dark streak betrayed the gorge of the Anambaruin-gol. This glen, by which we went down from the pass, is embraced between low hills, and possesses a much steeper declivity than the western acclivity up to the pass. It forms, at all events in part, the eastward prolongation of our old latitudinal valley. Its character was however now so far altered that a stretch of hills ran down its middle. It was by the glen on the north side of these hills that we made our way down to the Anambaruin-gol, and on the south side of the same hills there was evidently a similar glen, which, starting from the lower and more southerly pass at the east end of our old latitudinal valley, joins the lower end of the new glen down which we were marching. The latter slowly widens out, the hills are gradually replaced by rounded mountains, and the bottom of the glen is stony, and the grazing good. In the end its watercourse becomes unusually deeply excavated; the northern terrace, on our left, is the most energetically modelled and is frequently divided into two or three steps; its bed was full of gravel. The Anambaruin-gol, down which a little rill of water was then trickling, though there were at the same time sheets of ice in its bed, also possesses a distinctly marked terrace on its left bank. On the right bank, where we pitched camp (alt. 2878 m.), there was a stone inclosure for sheep, as also a stone hut. But neither

appeared to have been used for a very long time: there was good grazing, but it was quite untouched. The balghun bushes were here very plentiful. This place, which the Mussulmans call Kan-ambal, a corruption of the Mongolian Anambar, is situated in a triangular expansion of the glen, where side-glens meet it from several directions, and concentrating themselves into a single transverse glen, force their way through the northern Astin-tagh, and finally lose themselves in the Desert of Gobi, in the way I have described in Chap. XXXII of vol. II.

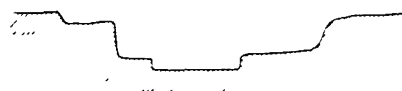


Fig. 260.

The same dark schists prevailed to-day that we had yesterday. East of the pass we again encountered green granite; but amongst the gravel were numerous pieces of gneiss.

Littledale's map gives no clear conception of the orography of the region; indeed it is difficult to make out which route he followed from Anambaruin-gol. Probably he kept to the same glen that I did as far as my camp, and then proceeded up another glen which we saw to the east-north-east, and which I visited subsequently. He too encamped beside the Anambaruin-gol, though not at Ja-ma-tschan, because of the existence of that well-hidden, well-screened spring his guide had no knowledge. He encamped at a point not very far from the little pass; he calls the place Kong Lugu on his map, though this name was not given to me.

To judge from its deeply excavated transverse glen, which ran N.  $63^{\circ}$  W (as seen from the camp), the Anambaruin-gol must sometimes swell to a considerable stream in summer and after rain. The water which we then found in it issued from a perennial spring on the right bank, the water having a temperature of  $+5^{\circ}$  at the point where it emerged to daylight. Close beside it there is a small pool, which no doubt remains unfrozen all winter, and it is only a little way below it that the ice-sheet begins. Of the two glens which we saw running towards the east-north-east, the more southerly one is deep, narrow, and modelled with energy, while the more northerly one is broader and shut in by lower, rounded mountains. I was now anxious to find a Mongol guide to conduct me to Anambaruin-ula; but none of my Mussulman attendants had ever been farther east than Kan-ambal, and consequently none of them was able to tell me which of the two glens alluded to would be likely to take us to our goal. A couple of my scouts reported indeed that in the southern glen they had seen wild yaks, arkharis, and *kökmets* (goats), a circumstance pointing to the probable absence of human beings in the neighbourhood; nevertheless this was the glen which I selected. But before proceeding to describe my journey all round Anambaruin-ula, I will add a few words about the glens that run down from the Astin-tagh into the Desert of Gobi.

In Chapter XXXII of vol. II I have enumerated the points (glens and springs) at which one of my men, Tokta Ahun, would halt whilst making the journey from Anambar to Abdal, and also compared the names which he supplied to me with those which are entered on Littledale's map. The itinerary which I am now describing ran south of Littledale's, with the exception of the last two days' marches, which coincide with his. Since my route thus lies a step higher than his in the Astin-tagh system, and is separated from it by a mountain-range, I had no oppor-



tunity to complete his map, which does not warrant any safe inferences with regard to the orographical structure. For instance, from it one cannot make out how the chain, which I have called the Lower Astin-tagh, runs as compared with his route. The map does, it is true, convey the impression that the chain lies the whole of the way north of his itinerary, until at Ghuletschen-bulak it comes entirely to an end. The fact that his route goes over two passes makes it very doubtful whether he ever did cross the range at all. But, as I have said, the map is not sufficient to settle the point.

And the same insufficiency attaches to the information which I received from my guides with regard to that lower route; yet the principal items of what they did tell me, such as they are, I will at any rate communicate, for they do throw some light upon the geography of the region. My men also drew for me a couple of sketch-maps, although with regard to their topography they are extremely unreliable and not worth of being reproduced. The nomenclature is however always of interest, and the mutual situations of the places with regard to one another will probably be correct.

The itinerary in question begins at Basch-kurghan and proceeds up the broad glen which we saw from that point opening to the east, and which terminates at the transverse glen of Tatlik-bulak. After that it follows for some distance the valley between the two chains of the Astin-tagh. Two other glens also converge upon the transverse glen of Tatlik-bulak, namely that of Kamisch-bulak and that of Tschokoluk-saj, both originating at Tschokoluk-tus, an open area in the Upper Astin-tagh. And through the same breach the glen of Semilanu-jan-bulaghi makes its way; this glen furrows the southern flank of the Lower Astin-tagh, consequently the chain is not pierced here. To the same system belongs also a *tus-jev* (an open area), that is to say a latitudinal valley, but situated farther east. Towards the eastern end of this last there is a small pass or water-divide; and from it the drainage flows away west to Tatlik-bulak and east to Satschkan-saj, the latter picking up from the right the glen of Kurhani-kosch-bulaghi, the name of which seems to suggest a perennial spring. Hence the two last-mentioned glens would appear to cut their way through the Lower chain.

Next comes the glen of Dscho-bulak, which according to the description would seem to be rather complicated. It originates in the Upper Astin-tagh and pierces the lower range, describing a big loop, in that it flows first east, then north (including the breach itself), then north-west or west-north-west, and finally north or north-west, after which it dies away in the sandy desert, leaving a foothill range on the right. During this course it picks up a whole series of side-glens. Dscho-bulak begins apparently at a threshold in the latitudinal valley between the Upper and the Lower Astin-tagh; from the same threshold starts its side-glen, Musluk-saj, which, running north, breaks through the Lower Astin-tagh and joins the main valley soon after emerging from the mountains. Meanwhile the Musluk-saj itself picks up two smaller subsidiary glens from the west, namely the Kalama-saj, which starts in a part of the great latitudinal valley called Japkaklik-tus and pierces the Lower Astin-tagh, and the Atschik-bulak, which likewise is a transverse glen with a salt spring. The part of the Dscho-bulak which proceeds towards the east is situated in the great latitudinal valley, and is

joined from the left, that is from the southern slope of the Lower Astin-tagh, by a small side-glen in which the spring of Dscho-bulak itself is situated. Another spring on the southern flank of the Lower Astin-tagh is that of Ghuletschen; its watercourse runs west and enters that of Dscho-bulak, after which the united stream breaks through the range, though not before both have been joined by several watercourses coming down off the northern slope of the Upper Astin-tagh. After piercing the range, the main glen is joined from the right by a minor glen called Maja-bulak, with a spring in its upper part; also by a second similar glen that is unnamed and possesses no spring, and by a third called Tasch-köl, in which a tiny lake is wont to remain after rain. On the left it is joined by several side-glens issuing out of the northern face of the Lower Astin-tagh, namely the Kutaslik-saj, Bilejlik-saj, Hadschughu (or Hadschögö) and Kitaj-kongan-saj, with finally the above-mentioned Musluk-saj. Here, as at Ku-schui-cha, it is characteristic, that not only the greater number of the side-glens, but also the largest, come from the south, from off the northern face of the Astin-tagh, whereas the side-glens that come from the right proceed out of a minor offshoot of that chain. The name Dscho (= Lhasa) is also significant; possibly it serves to indicate that a road once led this way towards Lhasa.

A stage farther east there appears to be a second minor glen called Dscho-bulak; this effects a junction with the gorge that leads down from the pass of Kara-davan, picking up on the way two side-glens known as Tasch-köl, both from the left. The stream which courses down this gorge is said to be very deeply trenched at the spot where it is crossed by the lower road. The great pass of Kara-davan, which this same lower road likewise crosses over, appears to be situated in a branch of the Lower Astin-tagh. All the same there exists not far away, though in the main crest, a smaller and easier pass, called Kara-davan-künäsi, from the fact that it lies open towards the sun. From these two passes a transverse glen, the Kara-davaning-saj, goes off to the east; but it does not force its way through the Lower Astin-tagh, its springs lie on the north side of the chain. It is joined from the right by the side-glens of Polat-bulak-saj and Hun-tschan-saj. In this region there actually appears to be a belt of sand spread out at the foot of the Lower Astin-tagh; Littledale's map seems indeed to hint at something of the kind, for the mountains on the right-hand side of the lowest part of Dscho-bulak are labelled »Mts sinking into Sandy Hills».

Proceeding farther east from Kara-davan we have the following side-glens, all situated in the northern face of the Lower Astin-tagh — Jangi-su, Kara-saj, Arkarlik-saj, Dole-bulak-saj, Kadschävä-saj (which also bears the descriptive name of Kamisch-bulak), Atschik-su, Toghrak-bulak, then two unnamed glens, and finally Lap-schi-tschen. All these glens are stated to terminate in the sand. The three following glens, situated between the two Kara-davan glens — Islam-tapghan-bulak, Kum-bulak, and Chodscha-schukur — possess the same rank as the sajs which I have just enumerated. The upper part of the last of the three is separated from the upper part of the eastern glen of Kara-davan by a difficult and inconvenient pass. Kum-bulak is situated, as the name implies, in a district with dunes of drift-sand; these are said to form a crescentic belt stretching between two offshoots of the

Lower Astin-tagh. From Tasch-köl, which we find on Littledale's map, it is reckoned a day's journey to Kum-bulak, and from Kum-bulak it is barely half a day to Chodscha-schukur, and from there a good stiff day to Dole-bulak, the road crossing on the way the lower parts of the sajs of Kara-davan, Jangi-su, Kara-saj, and Arkarlik-saj. All along this stretch there appears to be nothing but desert towards the north, with possibly a small mountain-ridge or so in the far distance. From Dole-bulak it is counted a day's journey to Toghrak-bulak, and from there a long day to Lap-schi-tschen. This is evidently the same route that Littledale followed. Lastly we have the system of Ku-schui-cha, which a long way to the west is joined by Lap-schi-tschen and the five transverse glens. Of these five the one farthest west is reported to enter the Lap-schi-tschen, while the other four combine two and two before issuing upon the main glen. By proceeding eastwards from a broad open glen that joins the glen of Ku-schui-cha from the right, one may cross over a secondary spur, though by a very awkward pass, into the next north-going transverse glen in the northern flank of the Astin-tagh. This transverse glen was called by my men Kan-ischlaitighan-saj, because gold occurs there, and was formerly extracted by Tungans. The *baschi* or »head» of this glen lies directly over against the *baschi* or upper part of Ja-ma-tschan on the other flank, that is to say these two glens start on opposite sides of the main crest of the Astin-tagh.

Unsatisfactory though this description of the natives is, it nevertheless enables us to infer, that the northern flank of the Astin-tagh exhibits a far greater energy and variety of development than, for instance, the Kuruk-tagh, the southern face of which likewise looks out over the same desert. Of the two routes — the lower, to the north, which Littledale selected, and the higher, to the south, which I mapped — the latter is beyond doubt the more convenient, because the ground is level, whereas the former pretty certainly crosses over a whole series of ravines and watercourses that issue out of the transverse glens.

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## CHAPTER XXI.

### SOUTH OF ANAMBARUIN-ULA — SÄRTÄNG.

Of this present journey it only remains that I now describe the hurried reconnaissance which I made round the immense mass of the Anambaruin-ula. I call this journey of set purpose a hurried reconnaissance, because want of time did not allow me to make anything more of it. My object was to travel from Anambaruin-gol or Kan-ambal directly north to the Kuruk-tagh and the ruins of Lâu-lan, which I had discovered the year before, these being the real goal of the entire journey. The reason why I now sacrificed more than twenty days to an excursion to Särtäng was that we wished if possible to buy camels, as well as provisions, from the Mongols. Hurried and incomplete though the excursion was, it nevertheless enabled me to secure a general view of the great mountain-knot. Unfortunately I was prevented by the season of the year from attempting minor excursions up to the higher parts of the mountain, so that the information which I am able to give with regard to its structure and relief is consequently very imperfect.

On the 3rd of January we started, then, to ascend the *thalweg* of the Anambaruin-gol. The contribution made by the glen that we saw coming down from the east-north-east (which we examined on our return) is but insignificant, and then only after rain; at this time it was dry. At the point where the Anambaruin-gol debouches upon the great expansion of the valley of Kan-ambal, we perceived, on the right bank of the watercourse, some Mongolian stone walls of the same kind as the quadrilateral walls which we found again lower down beside a spring, that is to say, they were constructed of blocks of stone more or less rounded, and cemented together with clay. The largest quadrilateral was protected on the side next the stream by a double wall, the original wall having apparently collapsed, and a new one, 1½ m. high, had been built inside the old one. In the interior there were distinct traces of a yurt; and the object of the wall seems to have been to protect the tent against the wind. At the south-eastern corner of the inclosure was a round tower, though barely 2 m. in height; it was difficult to make out what purpose it can have served. Thus, in this expansion of the valley, we have in three distinct places come upon traces of permanent dwellings, namely, this one which I have just described and which we subsequently learned bears the name of Sume; secondly

that at Camp CXIV; and thirdly that in the transverse glen of the Anambaruin-gol (see vol. II p. 472), which would seem to have been occupied by Tungans or Chinese from Sa-tscheo.



Fig. 261. A FREE-STANDING RIDGE IN THE VALLEY.

Soon after that the valley narrows, and is deeply trenched between the mountains, and at the same time the ascent is appreciable. The watercourse itself has cut deep down into the gravel-and-shingle detritus, and has in general vertical sides, consisting not infrequently of two or three steps or stages. We crossed over the watercourse in the very throat of the glen, and then kept along its left, or southern, escarpment. Its bed was choked with gravel, amongst which there were sheets of ice in two places, proclaiming the presence of springs. The mountains on the right of the glen, that is the range which we had on *our left* and which narrowed to a point at the walls I have mentioned, have a very steep slope towards the south, and close in to their base creeps the watercourse. The southern range, on our right hand, which is here of course the main range of the Astin-tagh, is wild and majestic, being gapped by a host of transverse glens, the upper parts of which are steep, narrow, and deep-cut, though their outlets are broader. From them small side-glens proceed to join the watercourse of the main valley.

After that the valley assumes a peculiar form, a form however which would appear to be not unusual in the Astin-tagh, in that down its middle runs an elon-



Fig. 262. THE UPPER PART OF THE VALLEY OF ANAMBARUIN-GOL.

gated, free-standing ridge (fig. 261), with a bare precipitous slope towards the south. The main watercourse of the valley runs along the northern face of this ridge; but in two places the latter is broken by side-glens coming out of the main range to the south. These transverse glens cut through diagonally, and join the main watercourse at an acute angle.



Fig. 263. OUR CAMELS WALKING AMONGST SNOW.

After the median ridge comes to an end, the valley itself narrows. The northern range assumes more imposing dimensions, but still continues to consist of soft material and has rounded outlines. Sometimes we marched along the bed of the watercourse, sometimes on the scarped banks at the sides, though it was tiring work crossing over the innumerable rivulets and contributories, with their steep slopes and gravel-choked bottom. Higher up the snow lay thicker, and at last was of great depth. In some places it formed an unbroken sheet, being hard and tough as parchment on the surface. In the sheltered hollows it was in especial heaped up in enormous masses. The vegetation in the valley was relatively abundant and the grass good; here and there, both in the main valley and in the mouths of the side-glens, balghun bushes were growing. In a couple of places we perceived traces of tame camels: the Särtäng Mongols occasionally visit the Anambaruin-gol. Yak-dung was common, evidently left by wild yaks. Wild-sheep and partridges were numerous. Camp CXV was pitched immediately west of the flat threshold in the latitudinal valley, the inducement being both grazing and japkak scrub. The altitude was 3700 m.

At Sume the range consisted of a hard, dark, fine-grained species of rock, dipping  $78^{\circ}$  towards the S.  $18^{\circ}$  E. The small free-standing ridge was built up of a similar rock, though lighter in colour and dipping  $78^{\circ}$  towards the S.  $55^{\circ}$  E. The southern range was composed of green schist dipping  $75^{\circ}$  S. Generally speaking

the surface is plentifully strewn with gravel, stones, and disintegration products of all kinds.

January 4th. The weather was now generally calm and bright, but the thermometer dropped as low as  $-28.5^{\circ}$  C. The little threshold in the latitudinal valley was barely a score of meters higher than our camp. Its altitude was 3718 m., and it made a flat and easy swelling. The head of the Anambaruin-gol is here cleft in two by a flat ridge. The descent from the pass towards the north-east is on the contrary steep, going down by a narrow gorge destitute of hard rock. To the east there appeared an expansion, and upon it several glens converged, and then pierced the northern range in a single united glen, exactly in the same way as the



Fig. 264. GOING DOWN THE PASS.

Anambaruin-gol. It also has the same direction as the latter, namely N.  $60^{\circ}$  W.; but the breach it makes is more energetic and deeper, although grass indeed shows occasionally on its sides. We learned later that its name is Mo-baruin-gol. Just at the point where the various watercourses meet as in a funnel, before piercing the range at an altitude of 3585 m., a spring gushes out, giving rise to a rivulet, though it was then for the most part covered up with ice and snow. Just above that there are in the gravelly bottom a couple of insular strips, on which grass and teresken scrub were growing. Here we detected comparatively recent signs of both men and horses; no doubt they were a party of mounted Mongols. We passed the open expansion going east, and then on the left hand, that is to the north-east, a side-glen leading up to a pass, by which the range that is pierced by the Mo-baruin-gol can evidently be crossed over with ease, and so another latitudinal valley be reached over on the northern side of it, running parallel to that in which we were then travelling. The two valleys are thus separated by a relatively low crest, over the top of which we perceived a rather large range bordering the new latitudinal

valley on the north; this no doubt starts in the greatest swelling of the Anambaruin-ula.

After that our latitudinal valley turns towards the east-south-east, and carries the largest drainage stream of the region, namely the Mo-baruin-gol proper. This in the expansion of the valley is as much as 100 m. broad, and is in general bordered by low scarped terraces; indeed it is only at the bends, and where the southern tributary glens emerge, that these terraces attain any noteworthy development. They are frequently clothed with vegetation, and even in the watercourses that are choked with gravel small islands of vegetation show here and there. Higher up the valley the stream is narrower and its containing terraces higher. The southern



Fig. 265. UPPER PART OF THE VALLEY OF ANAMBARUIN GOL.

range terminates in a dark, sharp-cut crest, with occasional strips of snow, and is flanked by a confused congeries of rounded offshoots, ramifying arms, and hills, filling the space between itself and the *thalweg*. In and out amongst these wind the deeply trenched transverse glens; they are far more numerous than those of the northern range. The watercourses that issue out of them, having steeply scarped sides, forced us to keep almost all the time to the bottom of the main valley. On the west side of some of these ravines the snow lay as much as two foot deep. A little way up the valley a spring gushed out, and gave rise to a long strip of clear, pure blue ice.

After threading some narrow passages in the valley, we found that it again widened out, and at the same time the eroded terraces came to an end; the northern range grew lower and lower, until it was like a chain of hills rather than a mountain-range. The southern range too decreased in altitude; yet after all it was only apparently that it did so, for it was the difference in the relative heights of the range and the bottom of the valley that decreased. Already it appeared likely



that we should be able to cross with ease over what had lately appeared such a stupendous mountain-knot. The pass at the head of the valley was a flat, convenient *bel*, devoid of vegetation, like the upper part of the latitudinal valley. Its altitude is 3888 m. I do not know its name. The Särtäng Mongols told me that one of the passes which we crossed over is known as Anambaruin-kötel; but this name belongs probably to the threshold on which the Anambaruin-gol originates. The more easterly pass which we have now reached is said to be called Anambaruin-eken-davan. On its summit stands a pyramid of stones, an indication that a Mongol road runs that way. From beside it we commanded a magnificent view across a fresh large open valley expansion, a gathering area, which however, contrary to the two preceding valley expanses, opens out southwards to the basin of Tsajdam. To the north, on the other side of the range which on that side borders the valley of the Mo-baruin-gol, we observed another latitudinal valley, parallel to the last-named, and identical with the one to which I have already alluded above. Even though I did not visit this new latitudinal valley, I nevertheless make bold to say, that it possesses a saddle divide which plays the same important orographical role as that on which we at that moment stood: namely it acts as a water-divide between the Desert of Gobi on the north and the basin of Tsajdam on the south. This supposition stands however in need of further confirmation. To the N. 80° E. there opened out yet another latitudinal valley; apparently it formed the orographical continuation of the one I have just mentioned, for it is in that very quarter that the latter debouches upon the valley expansion which we were looking down into. South of its termination or outlet rises an imposing mountain-mass, which, as seen from the pass, appeared to be almost free-standing. In the actual outlet of the valley there is a spring, with both open water and ice. In this locality we failed however to detect any signs of a road, though lower down in the valley expansion we did observe two cairns of stones.

The descent eastwards from the pass is very gentle. The valley expansion has a slope towards the south-east, and in the same direction we perceived a range which appeared to decrease in altitude towards the west and soon afterwards came to an end. We pitched Camp CXVI (alt. 3819 m.) under the shadow of the mountains on the north-east of the valley expansion, and in a barren, desert-like locality. Beside it was a shallow watercourse filled with gravel and having a sprinkling of japkak scrub alongside it. There was no spring, but on the other hand a plentiful supply of snow; it formed in fact a continuous sheet, except for an occasional stone sticking up through it.

At the head of the transverse glen of the Mo-baruin-gol was an unimpaired green schist, dipping 28° towards the S. 5° W., and a little higher up in the latitudinal valley a similar variety, though less schistose in character, dipping 50° towards the N. 20° W. Higher up still there was a marble-like rock dipping 48° towards the N. 5° E., and some distance west of the pass a red crystalline schist dipping 66° towards the N. 55° W. Granite also occurred amongst the debris of the gravel-and-shingle in the valleys.

January 5th. Accompanied by a hard gale from the west, we continued our route down the great open latitudinal valley towards the south-east, having in front of us the silhouette of the mountain-range which appeared to block our valley. The

range in question culminates in three great domed summits, S<sub>1</sub>, T<sub>1</sub>, and U<sub>1</sub>. At the northern foot of this range the snow lay thicker than anywhere else, for it was there screened against the sun. Our valley was very broad and open, and was fenced in on both sides by parallel mountain-ranges, each with a gravelly watercourse running along its foot, often fairly distinctly outlined. From Camp CXVI we followed the left-hand watercourse, and soon found that it joins the right-hand one, which appears to be the main drainage artery of the valley. Apart from these, the bottom of the valley is furrowed by a number of rainwater channels, most of them issuing out of the transverse glens of the range on the left. Two of these are of considerable size, the others very shallow. Here again we came upon distinct traces of a road; five horsemen had travelled along it recently. It runs quite close to the southern foot of the left-hand range, doubling one after the other the dark rocky spurs which jut out from the massive R<sub>1</sub>, the culminating portion of that range in this locality. We crossed over the soft, rounded continuation of one of these spurs and then a couple of watercourses in which *japtschan* scrub was growing rather abundantly. In a region so barren as that such a discovery naturally afforded a pretext for a rest, during which the men collected all the fuel they could for their camp-fires at night.

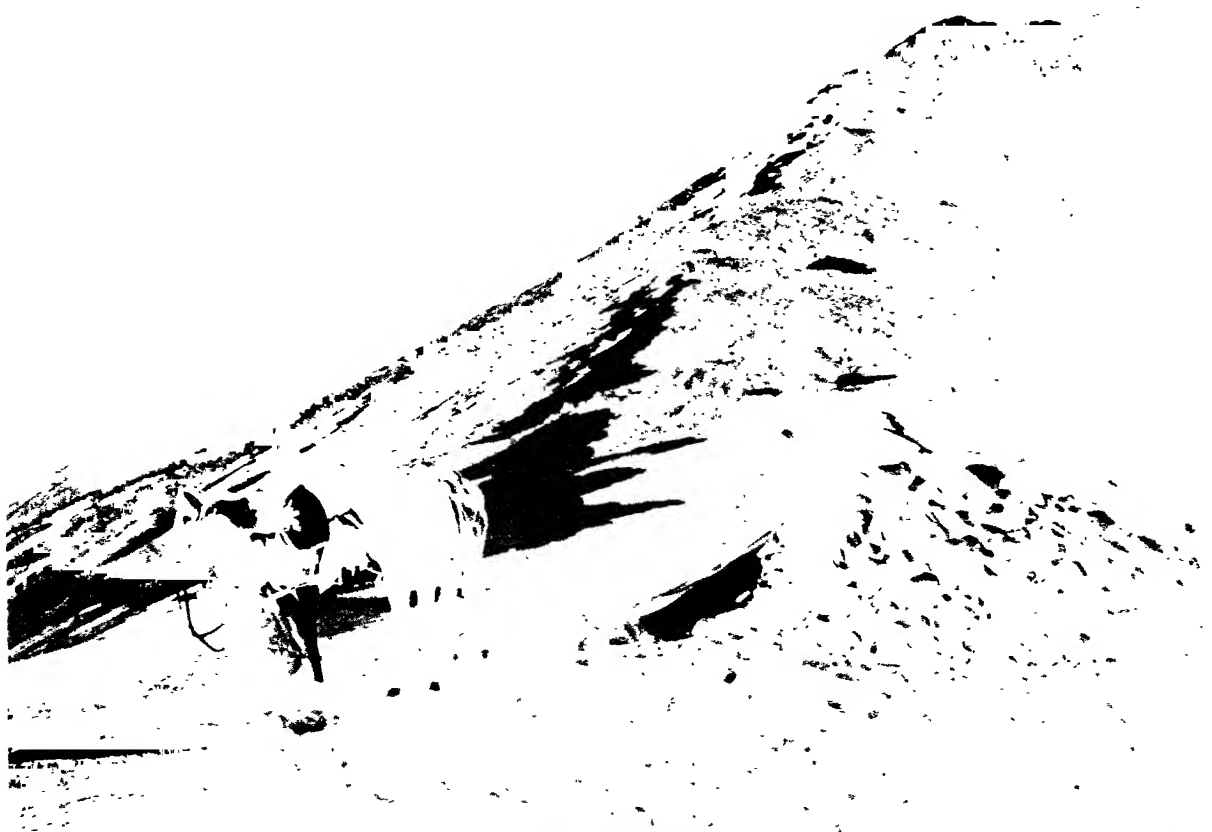
Then we travelled east-south-east. To the S. 22° W. we perceived the exit of the main drainage-artery of the valley. At that point the range which we had hitherto had on our right grew lower and lower and at the same time receded from the main watercourse, leaving it a free passage between its eastern wing and the range S<sub>1</sub> T<sub>1</sub> U<sub>1</sub> on the other (eastern) side of the gap. Through this rocky portal we saw to the south yet another parallel range belonging to the Astin-tagh system. This, running south-east or east-south-east, is a large mountain-ridge, and its eastern promontory touches the right-hand side of the main watercourse on the lower side of the gap.

By means of a short reconnaissance I learned that the watercourse in question, after running some distance towards the south-south-west, turns to the south-east, and then, having swung round the south-eastern promontory of the southernmost range, proceeds south-west, and so enters the northern basin of Tsajdam. The glen by which it breaks through is fairly broad, but owing to its very serpentine course we saw, from our line of march, nothing of the flat desert regions of Tsajdam. In this glen again the snow was heaped up abundantly on the barren *kakir* ground.

In this locality the Astin-tagh system, for we were orographically still within its domain, forms a pretty sharp angle. Hitherto we have found that its ranges run regularly towards the N. 60° E.; but now, just west of the great southern transverse glen that I am speaking of, it bends towards the south-east. On the east side of the glen however it again assumes an east-north-east direction; and this applies not only to the range S<sub>1</sub> T<sub>1</sub> U<sub>1</sub> on our right, but also to that which lay to the north of our route. The former range presents a very uneven and fantastic outline, the depressions between its peaks being very pronounced. All the ranges which we have had on the south since leaving the transverse glen of the Mo-baruin-gol — that glen opens out towards the north — may be regarded as foothill ranges of the Anambaruin-ula, an exterior bastion guarding the southern edge of the immense complex.



LOOKING SE. FROM THE SECOND PASS OF ANAMBARUIN-ULA.



*Ljustr. A. B. Lagrelius & Westphal*

ON THE TOP OF THE PASS.



Meanwhile we plunged into a labyrinth of small mountains and hills, the route we were following not only being very distinct, but showing evidences of having carried a lively traffic; for cairns of stones crowned the more prominent headlands and the more conspicuous hills. In and out amongst the hills wind a great number of small watercourses, all of which eventually join the main drainage channel that flows down from the east, for our latitudinal valley was now sloping upwards in that direction. This channel too makes its way to the great transverse glen recently mentioned. From the orographical point of view however we were still travelling in identically the same great latitudinal valley. But now the range which we had hitherto had on our left came to an end, by breaking up into the above-mentioned labyrinth of hills. Then, after crossing over yet other eroded watercourses and yet other spurs of the mountains, as also a large side-glen coming from the north, we approached the large watercourse that was advancing to meet us from the east. Although it is very shallow, this channel does not form a particularly conspicuous feature of the landscape; yet its great breadth, taken in conjunction with other indications, reveal the fact that sometimes it does carry a very considerable flood; nor need this be wondered at, for after rain and the melting of the snow it must be joined by a great number of tributaries flowing down off the higher parts of the Anambaruin-ula, the snow-capped summits of which were visible to the north. From the point where we struck the main watercourse, our direction was east-north-east, we travelling all the time in the broad bed of the channel. This, which is seldom margined by distinct erosion terraces, runs very much closer to the southern range than to the northern. The bed is hard and gravelly, and made an excellent path for travelling on. Its left or southern bank is overhung by quite a small butte, the northern face of which has been encroached upon to such an extent by the floods which roll down the main channel that it forms a precipitous wall. Here we came upon traces of a Mongol camp, namely large stones arranged in a circle to keep the canvas of a yurt taut and firm, with a horseshoe-shaped fireplace of loose stones in the middle. Not a very inviting camping-ground, for the neighbourhood is absolutely barren, except for very occasional scrubby *japtschan*. However there were also traces of camels, horses, sheep, and cows; evidently some body of Mongols had halted there in summer whilst on their way to more luxuriant pasture-grounds up in the mountains. For there exists a belt of grazing on the rounded flanks of the Anambaruin-ula, just as there does on those of the Tschimen-tagh and numerous other ranges in Central Asia.

Once past the little butte, we had the whole of the broad latitudinal valley spread out before us; the ascent was exceedingly gentle. Over a stretch of a couple of hundred meters in the bottom of the main watercourse, there burst up a great number of springs, which give rise to a gigantic sheet of ice, its surface studded all over with a vast number of small ice-*papillæ*, none exceeding 1 m. in height. Each of these little pyramids marked a spring, and each originated in the same way as the *ice volcanoes* on the Mus-kol in the Pamir or those beside the springs at Temirlik. The water forces its way out from underneath and forms thicker and thicker layers. Besides, cracks arise in the ice, and through these also the water trickles out and spreads over the surface. The clay around, then frozen as hard as

a stone, was cracked all over in a peculiar manner, some of the cracks being as much as 1 dm. across. The name of these springs seems to be Hundulung-ussu.

The ascent from them to the flat pass at the end of the latitudinal valley was virtually imperceptible. The country was bare and barren; no wild animals to be seen, nothing but a host of kulan tracks. The snow, which was extremely little amongst the recently mentioned labyrinth of hills, now increased again in quantity. Although the amount of snow crowning the chain of snowy peaks which we saw on the north, that is the main crest of the Anambaruin-ula, is not especially great, nevertheless it gives rise to three rudimentary glacier-tongues or hanging glaciers, pointed at their inferior ends. This snowfield is correctly delineated on the map of the Russian General Staff, although the representation of the Anambaruin-ula is on the whole rather schematic and haphazard.

The pass at the end of the latitudinal valley is so flat that, had we not had the watercourses to guide us, we might not have been aware of its position (alt. 3929 m.), and even when we had crossed over it, we hardly noticed any difference in the slope of the ground. In the east, but at a great distance, rose an immense snowy mass, belonging pretty certainly to the Nan-schan system, which Obrutscheff has examined. The valley then sloped down east-north-eastwards to a new spring in the bottom of its drainage-channel, where the grass was poor — at all events we on several occasions found better grass upon the plateau of Tibet. None of my men had ever before been in the part of the country in which we were then travelling, nor indeed had any European ever been there. Consequently I failed to obtain the names which the Mongols have given to these mountains, valleys, and rivers. Subsequently I was told however that the pass and the country adjacent to it are called Döröldsche, that the great transverse glen which I mentioned before is known as Ghodscha-tang, and the mountain-mass R1 is Taschir-gano. The spring at Camp CXVII (alt. 3903 m.) is said to possess the Chinese name of Sa-tschan. But as it is difficult to identify places merely by description at a distance, I cannot undertake to say that these names are rightly appropriated.

The rocks we marched through this day were granite, crystalline schists, frequently interpenetrated by veins of granite and quartzite, as also gneiss.

The gale continued to blow all night from the west, and so also on the morning of the 6th January, but at 1 p.m. it veered round to the east, and finally became north-east. Above the mountainous parts the sky was clear, but over the lowlands, which we now saw in the distance, light clouds were hovering. Our march lay through a monotonous region, though, as marking the close of my mapping of the Astin-tagh system, it was not devoid of interest. I agree with Sheet 62 of *Stielers Handatlas* in retaining the Turkish name as far as Anambaruin-ula, which may be regarded as a boundary between the Astin-tagh and the Nan-schan system, with its many parallel chains, farther east. It is however incorrect to call the former system either »Altyn-tagh» or »Ustun-tagh». Altin (Altyn)-tagh or Astin-tagh is the name of the lowest range of the system, Ustun-tagh the name of the upper range, though the latter is indeed a rather nebulous and general term. By means of the journey which I have just described, I fortunately succeeded in clear-

ing up the broad features of the system and its structure, though a great deal still remains to be done by way of detailed investigation.

From Camp CXVII the latitudinal valley has an extremely gentle slope towards the east-south-east, and its bottom contains but little gravel. The slopes on its right or southern side are scored by a great number of watercourses issuing out of the side-glens. Here too there are a couple of free-standing mountain-bosses. Just below them the main watercourse clings closely to the foot of the southern range, its spurs and buttresses plunging steeply down into its bed. Here we turned up out of the bottom of the watercourse and travelled along its left hand terrace, which is divided into three step-like divisions, the lowest of which is the most pronounced, often indeed quite vertical, and 4 meters in height, while the two upper steps are much less abrupt. From the top of the highest terraced step we commanded a view of the entire basin of Särtäng. In the east the icy expanse of the Bulungir-nor shone out clear and distinct; it appeared to be rather a small lake. The principal river of the basin, which originates in the perpetual snows of the Ritter Mountains, runs towards the west-north-west, and apparently, judging by the numerous serpentine strips of ice, is divided into several arms, all embosomed in yellow kamisch-fields of stupendous extent. The thick clouds of dust which hung in front of the distant mountains in the east suggested, that between their foot and the kamisch steppe there stretches a region of sandy desert or saj, the loose matter of which is lifted by the wind. We were just able to make out, faintly though still distinctly, the glaciers and snowfields on the Ritter Mountains.

Meanwhile we were marching obliquely away from the great eroded watercourse, the bottom of which becomes lower down filled with gravel; it then runs due east-south-east across hard saj, which has a very gentle, very uniform slope in the same direction, without any perceptible undulations, though it is furrowed at intervals by successive parallel eroded watercourses. The vegetation consisted of a thin sprinkling of teresken and other steppe scrub. At first the saj is rather gravelly, but the gravel is soon succeeded by coarse sand and earth. The Mongol track still continued to be distinct, though it did not appear to have been used for a long time past. Here again there were one or two cairns of stones, built however on the level ground. We were also marching away from the range on the right; at the same time it grew steadily lower, though forming a chain of bare denticulated, pointed crags. On the whole it appeared to curve like a bow, turning its concave side towards the basin of Särtäng. At intervals strips of snow gleamed out on its slopes; but on the inclined saj across which we were marching the snow had entirely disappeared. We were also travelling away from the main range of Anambar-ula; in other words the latitudinal valley opens out with a very wide throat towards the lowlands. The last peak of the main range that was visible, namely Y<sub>1</sub>, is considerably lower than those we have already noticed and its snowfields of less extent. At the same time the slope of the saj grew flatter and flatter, and was dotted all over with brown scrub, which came to an end at a pretty sharp boundary-line; on the other side of it there does not exist a single plant of any description. The saj is hard and perfectly barren, and in it disappear all the small dry torrents that we had hitherto seen; from which circumstance it is to be inferred

that no water ever gets down to these level lowlands, but is absorbed by the ground before it can reach them. Just as sharp as the boundary-line between the belt of steppe scrub and the barren saj was also the boundary-line between the last-named and the kamisch steppe, where we at length found plentiful grazing.

January 7th. By making this side-excursion to Särtäng I had departed entirely from the predetermined lines of my programme. I had not the smallest intention of investigating the geography of this basin: my real ultimate object was partly to explore the ruins of Lôu-lan and partly to carry out the levelling of the Desert of Lop which I have already described. What led me to extend my journey as far as Särtäng was partly the desire to buy camels from the Mongols, though in this we were not successful because of the excessive prices asked, and partly to purchase corn and other provisions for our own camels, an object in which we were quite successful. Consequently I only remained three days in Särtäng, chiefly with the view of resting the caravan. I am unable to make any noteworthy contribution to the geography of this region over and above what Prschevalskij and Carey have given us; the latter crossed over the basin from south to north, and in 1893—95 Roborovskij crossed it by several routes.

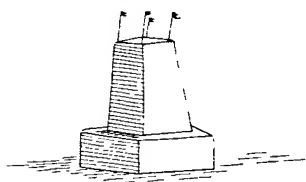


Fig. 266.

Our first object now was to get hold of some Mongols; but the part of the country in which the lakes are situated was, at all events at that season of the year, very thinly populated. From Camp CXVIII we made a short march towards the south-south-west across the kamisch steppe and the disagreeable lumpy schor. On the way we passed an obo of the shape shown in the accompanying illustration (fig. 266), called Højte-ovo, and decorated with four small streamers.

The country around it is called Højte-kövvö, or the «Farther Bank», that is the country on the other side of the Holuin-gol. At that time this river contained no water; at the point where we crossed over it, it was very shallow and only 4 m. broad, and was moreover covered with a thick sheet of ice. Over one of its side-branches the ice projected like a glass roof. The Holuin-gol issues out of the Bulungir-nor, a lake that is said to be fed by springs, and thus possesses the same area all the year round. Its water was perfectly fresh, but it is reputed to contain no fish. From it issues, as I have just said, the Holuin-gol and flows towards the south-west, to the Suchain-nor, the water of which is said to be salt, though not sufficiently so to prevent it from freezing. Thus the Suchain-nor represents the lowest part of the basin. This lake is also entered, south of the Holuin-gol, by the main drainage-artery of the entire region, a river that arises in the Ritter and Humboldt ranges and is said to be called in part the Halting-gol (Chalting, Chaltinguin-gol), and also the Boraguin-gol. In summer this river is said to swell to a large flood, though it can still be forded in several places.

Meanwhile we passed a solitary yurt, and then a couple of others in the locality of Sando, not far north of the Chalting-gol (2786 m.). Here we found but two families, whose only live-stock consisted of sheep, two horses, and one camel; but they owned in addition, they said, about 50 other camels, then grazing at a place three days' journey from Sando. At that time the country was reported to be very



thinly populated, for a large caravan had recently left it for Sa-tscheo to fetch in provisions, while a second caravan had gone to Donchur, with the object of making a pilgrimage to Kum-bum. The three places last named were the only ones that my informants were acquainted with, their geographical knowledge being restricted to their own immediate neighbourhood.

Although Carey and Dalgleish travelled across Särtäng from south to north, they do not show a single river on their map, and know nothing of the Chalting-gol, which is thus absent from the map of »Tibet and the Surrounding Regions». From this one would surmise that the river was quite insignificant when they forded it. The same thing is true in the case of Prschevalskij, who, although he too must have forded the main stream of the basin, does not indicate even the bare existence of any such stream on his map. The only names he records are »The plain of Sirtin, Bagha-Sirtin-nor, Ike-Sirtin-nor, and Chujtun-nor. On the other hand his map shows that the basin is completely engirdled with mountains on the south, just as it is on the east and north; though in the west it seems to lie open to the basin of Tsajdam, the two basins being evidently separated by a low threshold, otherwise the Suchain-nor would not lie where it does lie now, nor would it be salt. Prschevalskij's Bagha-sirtin-nor and Ike-sirtin-nor are unquestionably identical with the Bulungir-nor and the Suchain-nor. Thus though from Prschevalskij's map we clearly see that Särtäng is at all events an independent, self-contained basin, forming a sort of subsidiary basin to the greater Tsajdam, we get no light upon the matter from Carey and Dalgleish's map; the names recorded on it can hardly possess real names to correspond with them, for they are so corrupted as to be unrecognisable. They call the country itself the »Sirthang District», and make it to be bounded on the south by Makhai Kutil, on the north by Tawan Bulgan Kutil, these being passes in the bordering ranges. Their map contains neither rivers nor lakes, though in three places unnamed marshes are figured and in one place the bare word »Lake» occurs. The other names are Kutil Amun, Kuku Basching Taen Ekin, Chaga Namgha, Ulun Gazar, Bagha Nairin, Karim Gomba at Yempin, and Sair Galto. On the map of »Tibet and the Surrounding Regions» the basin form is clearly and distinctly shown, and the three lakes of Prschevalskij are duly inserted, but not a single river. The country is called in part Syrtyn Plain, in part Syrtyn District, the former after Prschevalskij, the latter after Carey.

The best map of this region is that of the Russian General Staff, after being supplemented by the material gathered by Obrutscheff and Roborovskij. On it the main stream of the basin is called the Chalting-gol, and it is shown issuing from the two great ranges which may in the meantime retain the names that Prschevalskij gave them, namely the Humboldt and the Ritter Mountains. It is made to flow towards the west-north-west and to empty itself into the Suchain-nor (or Ike-särtäng-nor), picking up on the way from the left the Bagha-chalting-gol, which rises on the snowy masses of the Ritter range. The Holuin-gol is correctly represented as issuing from the Bulungir-nor (or Bagha-särtäng-nor). The map then shows it entering the Chalting-gol, and it is very possible that it really does so, although the Mongols assured me, that both rivers empty themselves into the Suchain-nor, without effecting a junction one with the other. Immediately south of the Suchain-nor is a small

ridge bearing the name of Suchain-ula, and beyond it yet another range, south of and parallel to it, called Sirtin-machain-ula. It is in this last that Carey's pass of Makhai Kutil is presumably situated. The whole of this region demands a fresh and thorough exploration, and with it might profitably be combined an investigation of northern Tsajdam.

I was told that the lowest part of the course of the Holuin-gol is called Davasun-gol; from which I am disposed to infer that the freshwater stream flows into a narrow bay of the salt lake, the consequence being that the salt water advances a short distance up the Holuin-gol. Further, the lowest course of the Boraguin-gol is called Schara-gol, a name indicative of muddy water; the existence of the double set of names would seem to imply that the two rivers really do not unite. Possibly the Boraguin-gol is merely a deltaic arm of the Chaling-gol. This last is also called quite simply the Särtäng-gol. I was also informed, that the part of Särtäng across which I travelled is in summer converted in one great marsh, which can then only be traversed along certain lines. And this information is in so far corroborated that we did cross over a great number of more or less extensive sheets of ice, with polyp-like arms stretching in every direction. The great marsh is formed partly by the deltaic arms of the Chaling-gol, partly by springs issuing directly from the ground, several of which still continue to flow even in winter. On the map of the Russian General Staff these marshes are very emphatically delineated to the east of both lakes. With regard to the other names which I gleaned in this region, one or two admit of being identified with Carey's. Here follows my list: Särgelte-gol (probably a deltaic arm of the great river), Ulan-gadser, Tsagan-namaga, Kökö-bäsching, Utu-schirik, Kökö-sä, Mandolto-oktul, and Keten-nor, or the Cold Lake, which is reported to be situated in a cold, windy region two days' journey west of Sando; possibly it is identical with Prschevalskij's Chujtun-nor. Two passes are said to lead over the mountains to the north: Tschang-tse, situated to the north-north-east, and Davato, to the north-north-west. The latter leads to Bora-dschungdsching, where there are reported to be some Mongol settlers, owning in all about 50 camels. On the actual plain of Särtäng there would probably be altogether 60 to 70 tents, and about 100 others in the immediately adjacent mountains. The inhabitants belong, I was told, to the Mongol tribe of Kurlik-dolon-notuk-gurvun-sumun. Some of the richest of the Särtäng Mongols possess 1000 sheep, 20 to 30 camels, 100 horses, and 30 head of horned cattle; while a poor Mongol will own not more than a score of sheep. My host at Sando owned 10 horses and a hundred sheep. But at this season there were said to be no Mongols west of Sando. The Mongols of Sando itself purposed to remain at Sando over the summer; but many of their neighbours spend the warm months up in the mountains. In the course of the short distance that I travelled through Särtäng I saw in all 11 tents; several of these were however a great distance away. The last day of our stay certain other Mongols arrived, and pitched their tents in the neighbourhood of Sando. These Mongols evidently live in the same way as, for instance, the Kirghiz in Pamir: that is they remain in one district as long as the grazing is good, but when it is all consumed, they betake themselves to another locality. On the whole these lowlands gave the impression of being but thinly populated.

On the 11th January we once more resumed our north-north-east march across the level and monotonous, or rather rough, plain of Särtäng, with its steppes and wearisome frozen marshes; we had to strew earth on the ice-sheets before we durst venture to lead our camels across them. After once more fording the Holuin-gol and passing Højte-ovo (2816 m.) on the left, though at some distance away, we came to numerous dome-shaped ice-springs, and finally passed at 1½ to 2 km. distance the southern end of the Bulungir-nor, from which the Holuin-gol issues. Then we had the lake on our right (east) at the same distance; that is to say we were marching parallel to its western shore. It appeared to be of small size, though elongated, and along the shore lie numerous small pools and marshes and out in the lake flat islands. We pitched Camp CXX in a district called Eken-schirik, or the Grass of the Spring, where there was a little temporary obo, consisting of pieces of the schor ground stacked up one upon the other; while round about it were some broken slabs of stone with an inscription on them. The altitude was 2798 m.

Judging from its appearance and situation, the Bulungir-nor must be very shallow, or rather something between a lake and a marsh. It is fed, like the Baschkum-köl, by perennial springs, and here too the superfluous or overflow water makes its way by a small branch stream to a salt lake. This, the lowest depression in the basin, has the same value as the Ajagh-kum-köl, although it is incomparably smaller, and I dare say very shallow. As the volume of the Chaltin-gol must vary a good deal at different seasons of the year, it is to be inferred that the area of the lake likewise varies. Here too there exists a geographical homology, seeing that this lake receives a direct affluent from the highest bordering mountains on the south, that is to say an affluent which does not touch the freshwater lake. Precisely the same thing obtains in the basin of Kum-köl. The Bulungir-nor and the Suchain-nor furnish yet another example of the association of a freshwater lake and a salt-water lake so common in High Asia. Other examples of the same thing are supplied by the Kurlik-nor and the Tosun-nor; and again by the Ajik-köl and the Ghas-köl on the boundary between Tsajdam and Tschimen.

Yet another remarkable geographical homology comes to light when we compare the four basins which stretch in a string along the north-eastern edge of the great basin of Tsajdam, namely Särtäng, Machaj, Tsädum, and Kurlik-nor. The first and the last of these have this in common, that they each form one of a linked pair of freshwater and salt-water lakes. But Tsädum and Machaj are clearly self-contained basins, each consisting of two lakes; but with respect to these I am unable to give any special information. Each of these four basins seems however to possess a main affluent as well as several smaller ones. The map of the Russian General Staff calls the two lakes of the Machaj basin Dsun-machaj-nor and Barun-machaj-nor, that is the Northern and Southern Lakes of Machaj respectively. Carey's name for the former is Tsaghan-tolghaj-nor or Lake of the White Head. Its affluent, which flows down from the Ritter Mountains, is called Itscheghan-gol, though I was told that its name is Itscheguigol or Narin-holosso. From the maps it would appear that the basin of Machaj is bordered by mountains only on the north and east, while on the south and west there is flat land. So far as I know Carey and Dalgleish are the only travellers who have traversed this basin. But the word Un-

dulating» which they place on the map below the words »Makhaj District . that is to say south of the basin, seems to point to the existence of at any rate a swelling; and there must unquestionably be a similar swelling on both the west and the south of both its lakes, otherwise neither could have come into existence. It is very possible that the north-western half of Tsajdam, which is perfectly unknown, is broken up into several separate basins. The south-east part of the same great expanse also appears to consist of several smaller basins rather than of one single great basin, each possessing its own salt lake; but then these smaller basins are undoubtedly separated from one another by remarkably low and insignificant thresholds or swellings.

With regard to the basin of Tsädum, its two lakes are called by the Russian map Iche-Tsajdamin-nor and Baga-Tsajdamin-nor, though to me the names were pronounced as Ike-tsäde-min-nor and Baga-tsäde-min-nor. The name Tsajdam, which is found on all maps of Asia, is apparently an incorrect form, due to Przhevalskij's first journey. The correct name is Tsädum, and this is the form I also heard given to it by the Tadschinur Mongols in 1896; but at the same time it is not probable that the Mongols apply the name to the whole of the great basin, or mosaic of basins, which we call Tsajdam. All the same I have not ventured to eradicate entirely the accepted form: it may be retained in the meantime as the designation of a sharply defined geographical entity. The small basin of Tsädum proper ought possibly to be regarded as more correctly two, each with a salt lake. Into the Baga-tsäde-min-nor flows the large river of Kaktin-gol. The small mountain stream or brook of Takelgan empties itself into the Ike-tsäde-min-nor. The country between the two lakes is called Tavun-älesun, or the Five Sandy Deserts, so that it is evidently a sandy region; possibly the Five Dunes would be a better translation. The mountainous tract to the north of it is called Chergoldschin-ula, lead being found there, and extracted by smelting. With regard to the population, I was told that of the four basins Särtäng is the most thickly inhabited, and in each succeeding basin it grows less and less, so that the basin of Kurlik-nor and Tosun-nor contains the fewest inhabitants of all.

The rebellious Tungans, of whose flight westwards I have in the last chapter related one or two incidents, also paid a visit to Särtäng. My Mongol informant described dramatically how the Tungans to the number of 10,000 (this is of course exaggerated) came streaming down from the pass of Kökö-ussun and like a flood poured themselves across the plains of Särtäng, and they came down so swiftly and so unexpectedly that the Mongols only just had time to fly up into the mountains on the north, leaving behind them their flocks and their tents, which were plundered of everything they possessed. A lama, who had loaded up his possessions upon 30 camels, was perceived just at the moment when he was about to set off, and was attacked and plundered so thoroughly that he had much ado to save even his cloak. But not one of the Särtäng Mongols was killed. When they ventured down upon the plains again, after the departure of the Tungans, they were met by a distressful scene; it was as though the country had been visited by a plague of locusts, and heaps of bones lay in every direction, showing where the invaders had feasted upon the sheep of the Mongols. The horses and camels they took with them.

It was undoubtedly from this region that the Chinese authorities in Sa-tscheo were informed of the route which the fugitives had taken, so that they were able to intercept them in the mountains. The Tungans ran down also into the basin of Machaj, but were met with opposition, in the course of which several Mongols lost their lives. They did not however visit the basin of Tsädum. With the Tungans were a number of Kökö-nor Mongols, and they were the more formidable, being better armed and more skilful shots. Perhaps it was because of these experiences that I found the Särtäng Mongols far more reserved and uncommunicative than the Tadschinur Mongols whom I had formerly become acquainted with on the southern edge of Tsajdam. The latter were franker, and natural, and anything but suspicious. But possibly the Särtäng Mongols have been spoilt by their frequent intercourse with the Chinese of Sa-tscheo. The Mongols with whom I here came into contact, even the women and children, all spoke Chinese, though this was quite exceptionally the case with the Tadschinur Mongols. Marriages between the Chinese of Sa-tscheo and the Mongols of Särtäng are said to be by no means infrequent. In the summer the latter are visited by Chinese, who come to buy sheep. In fact, a large proportion of the sheep in Särtäng are reported to belong to the Chinese of Sa-tscheo and are looked after for them by the Mongols. In a word the latter are more exposed to the influence of Chinese predominance than the southern Mongols are, who enjoy a greater amount of freedom and independence. The Särtäng Mongols appear to have little intercourse with the Tadschinur Mongols, and indeed there is nothing to take them into the country of the latter. When journeying to Donchur and Kum-bum they travel by a more northerly route, by way of Kurlik-nor and Kökö-nor.

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## CHAPTER XXII.

### EAST AND NORTH OF ANAMBARUIN-ULA.

On the 12th January we turned our backs upon the basin of Särtäng and returned to the mountains on the north; and in proportion as we approached them so did the temperature rise, that is at night. At Sando the minimum temperature was  $31.^{\circ}7$ ; at Camp CXXI it was on the contrary  $20.^{\circ}1$ ; and at Camp CXXII.  $18.^{\circ}1$ . The first day's march was quite monotonous, although we observed a Mongol caravan of four camels and five horses making by another route for the pass of Davato; they were bound on a trading excursion to Sa-tscheo.

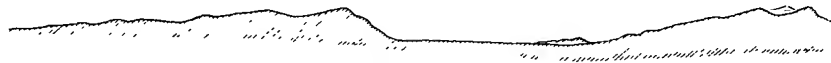


Fig. 267.

Our route of 12th January led north-north-east from Eken-schirik towards the glen-opening of Tschang-tse or Tschang-tsen, by which we were again to march up into the mountains. At first we had immediately on our right numerous marshes; pools, and rough sheets of ice at the springs. After that we left the northern part of the Bulungir-nor behind us and travelled across a thin kamisch steppe with schor. Then came a belt of soft barren soil, and this was succeeded by the hard saj, strewn with gravel and coarse sand, and furrowed by an occasional faintly outlined watercourse. The flat gravelly scree had here precisely the same character that it had where we crossed it farther west on our way down into Särtäng, the only difference being that here, in the east, it was perfectly barren. There were no snowy peaks immediately in front of us; the loftiest summits of the Anambaruin-ula rose to the west of our route. South of the main range, which forms the direct continuation of the section W, V, Y., there appeared to be a smaller foothill range, broken by glen-openings at intervals. The glen nearest to us on the west was that which leads down from the pass of Davato. It appeared to be a large glen, and from it issued a considerable watercourse. The glen by which we ascended is much smaller and its watercourse insignificant. Close to the foot of the mountain, where the latter watercourse breaks upon the lowlands (though it soon after dis-

appears amongst the detritus), vegetation again made its appearance, but only in the shape of a sprinkling of scrub. We now obtained to the west a view in profile of the great latitudinal valley through which we marched down into Särtäng. We had it now in shortened perspective, and it was quite clear that the southern slope not only reaches farther down into the valley, but has also a far gentler incline than the corresponding slope on the north, which is both short and steep. On the range W, V, Y, the snow-fields on the north side are much more extensive than those on the southern side, and it is therefore fair to infer that the hanging glaciers are also larger and more powerfully developed on the north than they are on the south. When seen in profile, the bottom of the latitudinal valley has a more perceptible slope towards the south, a conclusion at which we had already arrived from the fact that the drainage channel of the valley hugs closely the foot of the southern range.

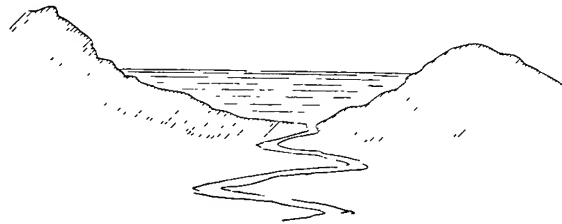


Fig. 268. VIEW TOWARDS THE SÄRTÄNG PLAINS FROM TSCHANG-TSEN.

Just outside the entrance to our transverse glen there was a small quartzite hill, crowned by a cairn of stones. We had also observed others at intervals along the track we followed, which was evidently a much frequented route. Not very far away to the east was the entrance to another transverse glen, which is said to lead up to the pass of Tsagan-davan, and in front of it are some larger quartzite hills.

The lower part of our glen is rather contracted and we soon began to feel the ascent; but it soon widened out; and upon reaching a fairly open part, known as Gurvun-tang, where three glens meet, we encamped (alt. 3519 m.). Thence a track runs to the N.  $47^{\circ}$  E. up to Tschang-tsen; this is the usual route to Sa-tscheo, though not in winter, because of the sheets of ice that are formed in its *thalweg* by springs, and which are dangerous for both horses and camels. Another glen leads north-west up to the pass of Scho-ovo-tu, and this was the route we selected.

In the entrance to the glen I noticed white quartzite, severely weathered, and a short distance up the glen a greenstone dipping  $59^{\circ}$  towards the N.  $8^{\circ}$  W. The débris in the bottom of the glen consisted of fragments of these two varieties of rock, with an admixture of grey granite.

January 13th. The parts of the great mountain-knot of Anambaruin-ula into which we had now climbed were very different from those parts which we have studied in the west. Here we had soft, sweeping outlines with vegetation, frequented routes, numerous recent signs of camps and camp-fires, and over on the north side of the mountains several tents and flocks.

In the morning the glen was shrouded in a pretty thick mist, and the sky quite clouded over. During the course of the day the clouds lifted a little, but the

mist still hung about the glen and to some extent prevented us from seeing. We only did a very short stage; but the country was picturesque and interesting, and the pass by which we crossed was more accentuated than any we had seen for a long time. Leaving on the right Tschang-tsen with its broader *thalweg*, we set our faces north-west and proceeded to climb up to the pass of Scho-ovo-tu, also pronounced Scho-voto or Schovot. The ascent, over soft earthy slopes, soon became quite sensible, and was even very steep for a short distance just under the pass. It is there that grass begins to show, but over on the northern side it soon became more abundant. The pass, which has an altitude of 3667 m., forms a sharp knife-back, on the summit of which only one, or at the very most two, camels are



Fig. 269. THE WAY UP TO THE PASS.

able to stand at once. The northern declivity is amazingly steep; in fact it was like standing on the verge of a precipice, and we were quite unable to see the level bottom of the valley far below. At the first glance it looked to be an impossibility to get camels down that breakneck acclivity alive. The torrent that runs down from the pass gave us not the slightest aid. The descent into the glen below was by means of a path on the left of the torrent, winding down by a countless number of short, steep zigzags, and at the bottom it brought us once more into the bed of the torrent. The descent was rendered still more difficult because of the quantity of gravel, of medium size and resting on an earthy basis, with which the path was strewn: the animals slid down it as upon wheels. If a camel were to lose his foothold whilst descending there, he would inevitably roll all the way to the bottom. The slopes and spurs on the northern face of the mountain are also covered with soft earthy material; the bare rock only makes its appearance at the foot of the declivity. Upon getting down we marched in the gravelly bed of the water-



course until we came to Scho-ovo-tun-buluk, a spring that breaks out in the entrance of a side-glen on the right, and at the same time forms a sheet of ice in the main watercourse. From that point the track follows the scarped hills on the right side of the glen, although these are cleft in very many places by the deep ravines of the side-glens. At times the path runs as it were along a shelf, being strengthened at dangerous spots by stone slabs. Several deeply trenched side-glens join the glen from the left also.



Fig. 270. THE WAY UP TO THE PASS.

At Dundu-buluk a second spring occurs in a side-glen on the right, and gives rise to a sheet of ice in the bed of the main watercourse. Here the grazing was fairly good on the flatter earthy slopes on the left side of the glen, and we counted some fifty horses at graze upon it. After keeping for a short distance to the left of the ice-sheet, the path crossed over it, and then ran up and down the bottom of the slopes on the right. Presently the glen widened out a little. The openings of the larger of the side-glens allowed us to see at their head the main crests of the two grand and imposing spurs which hem in this energetically modelled glen. We encamped in the throat of an especially big side-glen on the right, the watercourse of which was full of gravel and bordered by strongly marked, double terraces. Here the grazing was excellent, and there were four yurts in the entrance to the glen. This locality possesses the same name as the pass, namely Scho-ovo-tu, and it is said to be derived from the fact that on an adjacent height there are three obos (ovos). The altitude here was 3068 m.

The Mongols whom we found at this place had come from Särtäng three weeks earlier, and as soon as the grass was done, they intended to repair to some other side-glen in the neighbourhood. These people, together with several other

Särtäng Mongols, are accustomed to spend the whole of the winter in these mountainous regions, although they are sometimes driven out of them when the grazing gets covered by heavy falls of snow. It is said usually to be the north-west wind that brings the snow, although the snow-falls are on the whole just as irregular as



Fig. 271. GOING DOWN FROM THE PASS OF SCHO-OVO-TU.

the rains, being some years very abundant and very violent, while other years there are none at all. Sometimes it rains so violently that it is impossible to ford the brook of Scho-ovo-tu. If snow should fall at that season, January or February, the only course is to go down into the lowlands. The Mongols spend their summers



Fig. 272. GOING DOWN FROM THE PASS OF SCHO-OVO-TU.

in Särtäng; but their nomadic wanderings appear to be rather irregular, for very often they spend the warm seasons also in the mountains. It may seem strange, that these Mongols should pass the warm season in the lowlands and the cold season in the mountains, but as a matter of fact the winters are less severe in the mountains than on the plains of Särtäng, and it is evident that the winter grazing in the mountains is better than that in the plains, otherwise they would order their migrations in a different way.

The neighbourhood in which we pitched Camp CXXII is notorious for the extremely violent winds that occur even when the sky is clear. This day the sky was however covered with clouds, and consequently the atmosphere was almost still. When the sky is clear, this furious wind rushes over the pass of Scho-ovo-tu in veritable cascades; never in fact have the Mongols experienced a clear day in winter on which the weather was still. They pointed out where we ought to put up our tents so as to have them to some extent protected, and we noticed that their own yurts were exceptionally fastened down with ropes anchored to great blocks of stone. This furious wind is however only characteristic of the cold season, the summer is calm. Close under the pass and in the neighbourhood of our Camp CXXII the wind is icy cold, but lower down the glen it is warmer. Probably it is a variety of Föhn, conditioned in some way by the peculiar relations of altitude, the country to the south of the range lying much higher than the country to the north of it. Shortly afterwards we had an opportunity to observe a similar phenomenon in the throat of one of the northerly glens of Anambaruin-ula, and a similar cascade of wind pours with inconceivable violence down into the glen of Baltal over the stupendous staircase of Sodschi-la (Zoji-la) on the road from Ladak to Kaschmir.



Fig. 273. SECTION OF VALLEY AT CAMP CXXII.

In the pass of Scho-ovo-tu we found grey granite, splendidly exposed, but with an indistinct dip, though a little way north of the pass it appeared to be bedded  $58^{\circ}$  N. Next followed a schist resembling diorite and dipping  $5^{\circ}$  to the S.  $45^{\circ}$  W., and after that grey granite again. At Dundu-buluk there was gneiss or striped



Fig. 274. THE WAY UP TO THE PASS.

augen-granite, dipping  $73^{\circ}$  towards the N.  $80^{\circ}$  W. North of Tschan-tsen-davan there is a district known, it is said, as Tavun-buluk. If the name may be trusted — the word means the Five Springs — it would seem to be that of a northern glen, equivalent to the glen of Scho-ovo-tu, and like it possessing several springs.



IN THE VALLEY OF SCHO-OVO-TU.



*Ljustr A. B. Lagrelins & Westphal.*

A SHORT HALT.



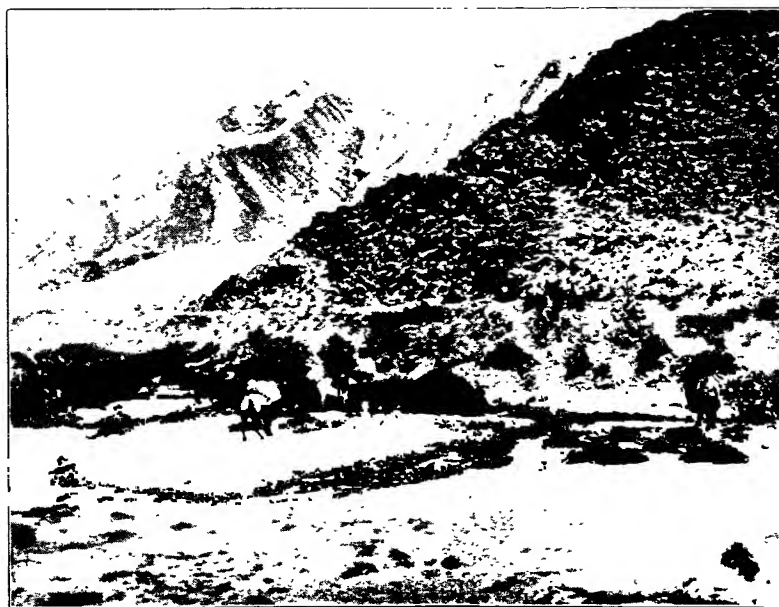


Fig. 275. VIEWS IN THE VALLEY OF SCHO-OVO-TU.

Another region, but without water, lying north-east of Tschang-tsen, is known as Moge-tädse.

The Mongols here, when questioned about the ancient road which we followed for so long from Akato and between the parallel chains of the Astin-tagh, were unable to give me any information about it. They had never even heard speak of the lake of Ghas or of the Tschimen valley. When I asked a shrewd old Mongol whether at some distant period his kindred had not possibly grazed their flocks in Tschimen, he asked me first how far it was to the place, and then how I came to imagine that sensible people would drive their flocks a twenty days' journey through

desolate regions simply to let them graze for a few months in that far-off Tschimen: he for his part had never heard speak of it, and did not believe it was possible. But since the road actually exists, as we have seen, and moreover bears indications of a pretty lively traffic, and since it is nevertheless indicated on Chinese maps, there remains only the great probability, that it was at some former period employed by the Chinese, although it is difficult to see what advantage it can have offered over other great routes of communication between China and East Turkestan. The only advantages that one can at all perceive would be the coolness and the freshwater springs in summer. Those who are versed in ancient Chinese geography will no doubt more readily find the solution of this problem.

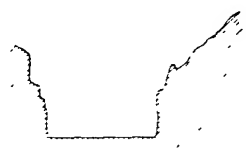


Fig. 276. VERTICAL SECTION OF BIG BEND.



Fig. 277. THE VALLEY BELOW DUNTSA.

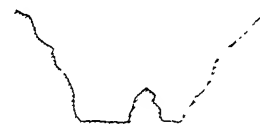


Fig. 278.

January 14th. This day too the glen was enveloped in mist, and the sky covered with clouds. Lower down the glen of Scho-ovo-tu grows still wilder and more picturesque. It is fairly straight and regular, with the exception of a single sharp

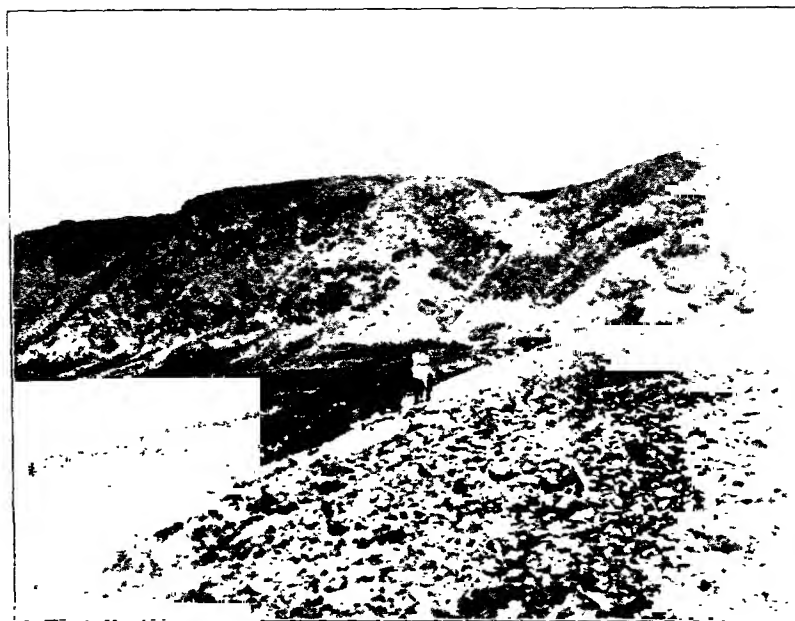


Fig. 279. FROM THE SCHO-OVO-TU VALLEY.

bend (fig. 276). Its slope is rather considerable, and when its brook runs full of water, it must form a series of tumultuous cascades and rapids the whole way down. Erosion has left eloquent testimony of its activity in the high, precipitous escarpments, which overhang it on both sides throughout almost its entire course; and the great in-



roads which it has made upon the rocky walls at the sharp bends, as well as the vast quantity of gravel and blocks of granite and greenstone which litter its bed, alike tell the same tale of the excavating power of the torrent. On both sides the glen is joined by short, steep side-glens, often of large size, sometimes breaking through the gravel-and-shingle terraces and even being equipped with such themselves, and sometimes piercing the bare rocky walls; in this latter case they terminate in narrow, yawning entrances like portals leading into the very heart of the mountains. After leaving the camp in the side-glen, we kept at first to the slopes on the right-hand side of the glen, which were steep, but soft, being fairly well grassed over. But upon coming to a projecting buttress, we were forced down a precipitous brae into

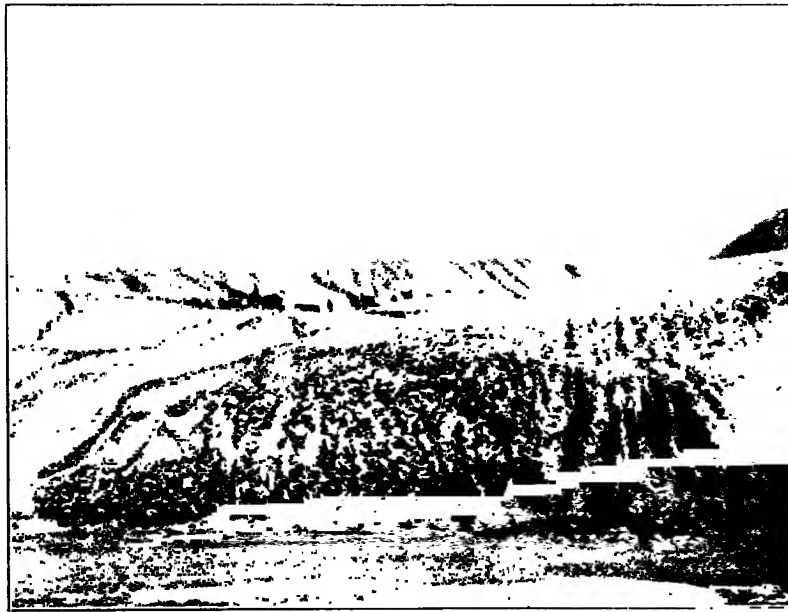


Fig. 280. THE SAME.

the bed of the stream. Right at the elbow there stands, in the very middle of the glen, a small narrow butte (fig. 278), about 15 m. high, quite isolated, and very peculiar — in fact like a column of stone sticking up out of the gravel at the bottom. At this spot there comes down from the right a side-glen, with a very contracted opening between walls of rock, and out of that rocky passage protruded a tongue of ice, issuing from a spring a little higher up the side-glen. The fourth side-glen on the right is called Duntsa; it too possesses a spring, which gave rise to a brook that for almost all the rest of the way down the main glen formed a sheet of ice, sometimes narrow, sometimes broad. Bushes again made their appearance in the lower part of the glen. The glen of Duntsa is pretty large and leads up to a pass. In it there were at that time no Mongols. Then for a space we kept to the terrace on the left side of the glen, it being there low. Still the track was throughout rather difficult, especially because of the great quantity of *débris*. For some distance the terraces on the right of the glen were double; then they decreased rather rapidly in height, and the bed of the stream grew broader. At the same time the mount-

ains also became lower, and to the north there opened out before us the boundless expanse of the desert, with a yellow haze hovering above it like the reflection of a drift-sand area. At the point where we descended for the last time into the débris-filled bed, we found a rather fine obo built up of slabs of stone, and resting upon a base of gravel and fragments of rock; it bears therefore quite simply the name of Manitu. When we at length turned out of the glen and directed our steps towards the west, the left-hand side consisted of double terraces, the lower one 6 m. high, the upper one 15 m. Here the mountains came abruptly to an end and the gravelly scree sloped away gently towards the north. The dry brook of Scho-ovo-tu



Fig. 281. THE LITTLE BUTTE IN THE VALLEY.

appeared however like a grey ribbon winding away for a great distance towards the north. We now travelled westwards, having the mountains on the south and the lowlands on the north; in this latter direction there was not the slightest indication of an elevation to be seen. In a word we had crossed right over the entire system. The surface consisted of dry, yellow soil, with grass and scrub growing amongst the gravel. Having crossed several rather small transverse ravines, we at length struck into a larger one running north-north-west. Here in an unnamed locality we pitched Camp CXXIII (alt. 2543 m.). In the same gully we found a wealthy Mongol, the owner of some tents. Just below Duntsa we had met five Mongols driving this man's live-stock — namely 8 camels, 400 sheep, and 100 horses — up to the spring, to give them water, for there was none nearer.



Fig. 282.



Fig. 283.

Just below Camp CXXII we found a rock resembling diabase, dark-green in colour and extremely hard, with a dip of  $74^{\circ}$  towards the N.  $65^{\circ}$  W., and just below it again a similar rock containing veins of quartzite and dipping  $58^{\circ}$  towards the N.  $45^{\circ}$  W., and after that a mica-schist dipping  $84^{\circ}$  towards the N.  $30^{\circ}$  E. Quite close to the end of the glen there was a light-coloured, fine-grained rock, forming on both sides of the glen shorn precipices capped with detritus of gravel-and-shingle to a depth of several meters (fig. 283). At the very end of the glen there was again a thick, hard variety of diabase.



Fig. 284. SHEEP AT DUNTSA.

Thus in the course of two short days' marches we had crossed right over the whole system, which does not therefore here exceed 16 to 17 km. in breadth. The most peculiar feature in connection with this range is, that it consists of a single, distinct, and sharply defined range, in contradistinction to the two or more ranges which make up its components farther west. Hence the water-divide between the basin of Särtäng and the Desert of Gobi is more plainly and sharply indicated; neither north nor yet south of the range is there so much as a single subsidiary range, however fragmentary or disconnected. It is evident that this relation is such at this one point only: westwards this same chain swells up to the mighty mass of the Anambaruin-ula, with foothills of considerable dimensions on the south, while farther east the range, according to Prschevskij's and Carey's maps, is double. The latter traveller calls the passes by which he crossed over the range Tawan Bulgan Kutil and Khupchiling Kutil. The simplicity of the mountains' outlines is also a striking feature; from Särtäng we ascended gently up to a pass close at hand, whereas on the northern versant the descent is both steep and long. The range is thus asymmetrical, the reason being that the southern basin has a very consider-

ably higher altitude than the desert on the north (fig. 285). But in a later chapter (vol. IV) I propose to discuss in a more accurate manner the absolute differences of altitude and the types of relief which characterise those parts of High Asia that were covered by my various journeys.

The glen in which our Camp CXXIII stood is also said by the Mongols to be called Scho-ovo-tu, so that this name is evidently applied to the entire region — pass, glen, and the locality around the lower end of the latter. Near this camp there were 6 yurts. Farther east there were Mongol camps in several other glen-openings, though there were none lower down, that is on the way towards Sa-tscheo. These Mongols, then dwelling at the northern foot of the mountains, betake themselves in the summer to Särtäng. One of our new neighbours asserted that on the plains of Särtäng there were more than 100 yurts, but that the total number of yurts in Särtäng, Machaj, Tsädum and Kurlik-nor, together with the adjacent mountains, amounted to over 1000 in all. Their most distinguished chieftain was said to be settled in Tsädum. From Scho-ovo-tu it was reckoned a journey of  $3\frac{1}{2}$  days to Sa-tscheo; the first stage being as far as Sa-sän — judging from the name, a sandy desert; the second to Sa-tso-jentsa, formerly inhabited and with traces of former cultivation; and the third to Wo-ji-tschu (the Five Ariks), a village lying in the midst of cultivated fields. The last portion of the road runs beside the Danguin-gol (Tan-ho), both banks of which are inhabited by Chinese. Beside the river, and not very far from the town, there are said to be two ruined *sozurgas* or *tschortens*. Another place that is inhabited by Chinese agriculturists is Tuj-murtu. On the north side of the belt of sand is a district called Schi-cho-li. Although several European expeditions have touched the country round Sa-tscheo, a thorough revision of the entire region would, it seems to me, do no harm. Several of the Mongol names on the map of the Russian General Staff are unrecognisable. Tam-bulak, for instance, ought to be Tavun-buluk, or the Five Springs, and indicates unquestionably the lower end of the glen of that name mentioned above.

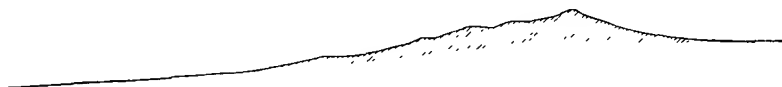


Fig. 285.

On the 15th January, whilst we were resting at Camp CXXII, the sky became clouded and a very heavy fall of snow took place. From 8.30 p.m. onwards we heard a »swishing» noise in the mountains: this was, we were told, due to the violence of the wind in the glen of Scho-ovo-tu, and it was considered to be a proof that the sky above the top of the range was then clear, although it was snowing fast at its northern foot. On the morning of the 16th the entire country, mountain-slopes included, was buried under quite a deep canopy of snow, which was everywhere continuous, and so thick that nothing was seen sticking up through it except scrub and the edges of the scattered stones. During the forenoon the sun shone out for a while, but the sky soon clouded again, and the mountains became in part hidden behind the driving snow and the mists; so that unfortunately I was not able to take the bearings of the more conspicuous of the peaks of Anambaruin-ula.

Our next short march, from Scho-ovo-tu, led towards the south-west, our route making an acute angle back to the immediate neighbourhood of the base of the range, while the ascent was quite sensible. It was difficult marching by reason of the countless number of deep and tiring gullies and eroded watercourses. These are generally 2 to 3 m. deep; but there was no escape from them: we had to go down into them and then up again, each in turn, and not seldom we had two of these to deal with in the course of only five minutes. They are more or less filled with gravel and are grassed at the sides. Their direction is north-north-west, and upon reaching the lowlands, they appeared to unite into a larger stream which inclined steadily towards the west, though I was not able to see quite certainly because of the mist. After it had cleared a little, we were able to make out that the surface falls away for a great distance towards the north, while far away were white strips of snow alternating with dark strips of bare ground, and still farther beyond them a confused thickening, which looked like a low ridge of no importance, probably the extreme eastward continuation of the minor desert range which we subsequently crossed over whilst on the road from Anambar (Kan-ambal) to Atschik-kuduk.



Fig. 286. MONGOL TENT AT SCHO-OVO-TU.

One of the larger watercourses is known as Andscha-oyo, meaning, I was told, Andscha's Earthen Hill, and named after a Chinaman, who formerly lived there. The ascent continued to grow steeper, and became quite noticeable as we approached the first hills, where the watercourses were as much as 10 m. deep, and usually inclosed within perpendicular scarped walls of gravel-and-shingle and sand in alternate layers. In places where erosion does not exercise any direct effect, the slope is rounded and allows a passage for the track. Some of these gullies come so close together that a single wall of gravel-and-shingle, not more than a couple of meters

thick, serves to part two of them. Amid the universal whiteness of the snow these scarped precipitous faces had an appearance as of black curtains.

The track climbs up to a small secondary pass on the left-hand slope of the brook of Hun-tu-tschuen-tsa (the Red Spring), which runs towards the N. 10° W., and down on the other side there is a steep descent by a little side-glen to the larger glen of Davato. We encamped at the point of junction, close beside a square building, its walls constructed of gravel-and-shingle, the binding material of which had for the most part fallen out. From some fragments of whitewash that remained, the edifice would appear once to have had its walls painted. Our Mongol guide informed us, that it was a Chinese temple, and was destroyed some thirty or forty years ago by the Tungans at the time of their first revolt. The temple was exceptionally finely decorated, and possessed a large bell and several idols.

Nowhere did we see hard rock during the course of that day's march; the country was built up exclusively of gravel-and-shingle detritus, products of weathering, which at the northern foot of the Anambaruin-ula form a gigantic scree, gashed and furrowed by a host of brooks and rivulets running down from the mountains. The material consisted for the most part of the same greenstone as before. Large fragments were not uncommon; sometimes they assumed the shape of tables supported by pedestals of finer material. All the glens we crossed over, including the last one, Davato, in which we encamped, are much smaller than the glen of Scho-ovo-tu. This is strange, because the distance from the pass of Davato to the foot of the mountains is said to be considerably longer than the corresponding stretch in the case of the Scho-ovo-tu. On the other hand, the pass of Davato is said to be very much easier, the country on both sides of it being much leveller. At our camp (alt. 2805 m.) a spring gushed out in the bed of the Davato brook, forming a large expanse of ice, and we were told that there is another similar spring higher up in a side-glen. After heavy rain the brook of Davato is said to travel to something like a day's journey from its actual exit out of the mountains, that is to say as far as the beginning of the belt of sand, where lofty dunes are reported to be heaped up.

The grazing around the lower end of the glen of Davato was good, but there was no fuel. Partridges abounded there, as they generally do in the glens of the Anambaruin-ula. At 6 o'clock it began to blow down the glen with almost unparallelled violence. This wind is said to be characteristic of the winter, though not to be associated, as the wind is in the glen of Scho-ovo-tu, with a bright sky; but it also blows when the weather is dull, and after a fall of snow it is sure to set in. Before very long the wind in Davato quickened up to a veritable hurricane; it came from the south-south-west and did not blow steadily, but occurred in extremely violent gusts, threatening to blow over our tents, so that we had to lash them down with extra ropes and anchor them to big stones all round. This icy, blighting wind continued all night, although the thermometer did not drop lower than — 16°. It is therefore a characteristic of this typical Föhn wind that it raises the temperature of the air. It pours down the steep northern slopes of the mountains like an avalanche, filling up all their glens and being compressed in them to doubled force and violence. But it is confined exclusively to the northern slopes of the Anambaruin-



THE RUINED HOUSE OF DAVATO.



*Ljustr. A B Lagrelius & Westphal*

THE SAME.





ula, and is never observed on the southern side, nor yet in Särtäng. Indeed in this last region the spring and summer are said to be windier than the winter; but the Föhn of the northern versant never blows except in winter, at any rate it is much feebler in spring, and does not blow at all in summer. It is clearly because of its local and strictly circumscribed range that the Mongol nomads prefer to pitch their tents some distance below the foot of the mountains, even though there be no water, and in that case the flocks have to be driven every day up to the springs at the end of some glen or other. The fact is that this violent Föhn wind is not observed at some distance from the foot of the mountains. And next day, no sooner did we cross over a low threshold just to the west of the end of the glen, than we no longer felt even the slightest breeze. This wind gave me the impression that it pours down the glen in exactly the same way as water flows down a river-bed.

On 17th January the sky was clear, though the air was full of tiny ice-needles, which glittered in the sun. The snow was 5 cm. thick. The view to the north still continued to be obscured. Our Mongol guides declared, that all the watercourses which we crossed over unite lower down to form one larger bed, which runs westwards, and this is indeed on the face of it very probable, for everywhere the ground slopes away towards the Lop depression. And far away to the north I fancied I could detect where that larger watercourse was situated, although at that season water never gets down so far, as well as a mountain-chain beyond it still farther to the north.

During the day the country became even more difficult than it was the day before in consequence of the still more numerous ravines and watercourses, all of which we had to cross transversely. Every other minute, sometimes indeed oftener, we crossed over these hindrances, while at wider intervals came the large drainage-channels, which issue from the bigger glens, and attain down where we were depths of as much as 30 m. It is a striking circumstance that the northern face of the Anambaruin-ula should be as it were honeycombed with thousands upon thousands of eroded rain-channels and glens, while the gravelly scree on the south side is so level and so easy, and its watercourses both few and extremely shallow. Something must however be set down to the fact, that on the south we kept at a greater distance from the base of the mountains, whereas here on the north we were marching quite close to them. Had we kept a farther distance out from the mountain-foot, the watercourses would naturally have been less accentuated, less deeply excavated, as we did indeed find to be the case with the river of Anambaruin-gol, which disappeared in the ground at no great distance from the mountains. At all events there is in this respect a great and real difference between the southern and the northern slopes. On the former there does not exist a single brook which for energetic modelling can be compared with those on the north, and the explanation is to be found simply and solely in the excentric structure of the range. The culminating crest is thrust a long way over to the south; the southern face is incomparably shorter than the northern; and the great bulk of the mountains, in consequence of the difference in the absolute altitude of the adjacent lowlands, comes to lie north of the main crest and of the pass. Consequently incomparably the greater part of the precipitation which is arrested by this range falls on the north side of

the water-divide, that is the culminating crest, whereas it is only a very inconsiderable portion which descends upon the southern flanks of the range. The result is what might naturally be expected: the gravelly scree on the northern side is deeply and abundantly eroded, whereas the erosive energy to which the southern versant is exposed is too feeble to leave any especially noticeable traces.

Our route, which cut all the northern watercourses and glens transversely, makes both horizontally and vertically a denticulated line, for on the tops of the intervening swellings and ridges it curves outwards towards the north, whereas in the bottoms of the watercourses between them it curves in the opposite direction, that is towards the south, the object being of course to preserve as far as possible the same horizontal level.

Precisely the same character and relief are exhibited by the country at the northern foot of the western Kwen-lun, especially in Kirk-saj or the Forty Gullies, which I visited in 1896 between Kapa and Sourghak, and have described in *Petermanns Mittheilungen*, Ergänzhft 131. There, just as here, that part of the northern versant which lies immediately at the foot of the mountains consists of soft earthy slopes, alternating with torrents cut through the gravel-and-shingle detritus and with a relative abundance of grass, which is visited by Taghliks, just as the grass is here on the northern face of Anambaruin-ula by the Mongols. I assumed that all the deep trenches which we were crossing at the cost of so much time would lower down become shallower and shallower, and I therefore asked my guides, whether we should not find it easier travelling if we kept farther out from the foot of the mountains; but they declared that we could not do so. The trenches do indeed grow shallower lower down towards the lowlands, and gradually converge and unite, but the watercourses thus formed are inclosed between deep vertical scarped terraces, and what is worse they traverse a perfectly barren region, where there is no water to be obtained anywhere. Thus the higher route that we were following was the only available one. Exactly corresponding circumstances are met with again in the country of Kirk-saj, where to the north of the grazing-grounds there extends a belt of barren desert, desert that is in so far as it is not fertilised by the streams that issue out of the larger glens, e. g. the Bostan-toghrak, Tolan-chodscha, Möldscha, and Kara-muran. As I have already said, the transverse glen of Scho-ovo-tu was the largest of those that we had hitherto crossed over. This may only apparently be the case, for if names are anything to go by, the Davato (or Davoto) ought to be bigger than the Scho-ovo-tu. Possibly the latter expands higher up and becomes a far greater glen than what its lower extremity would lead one to expect.

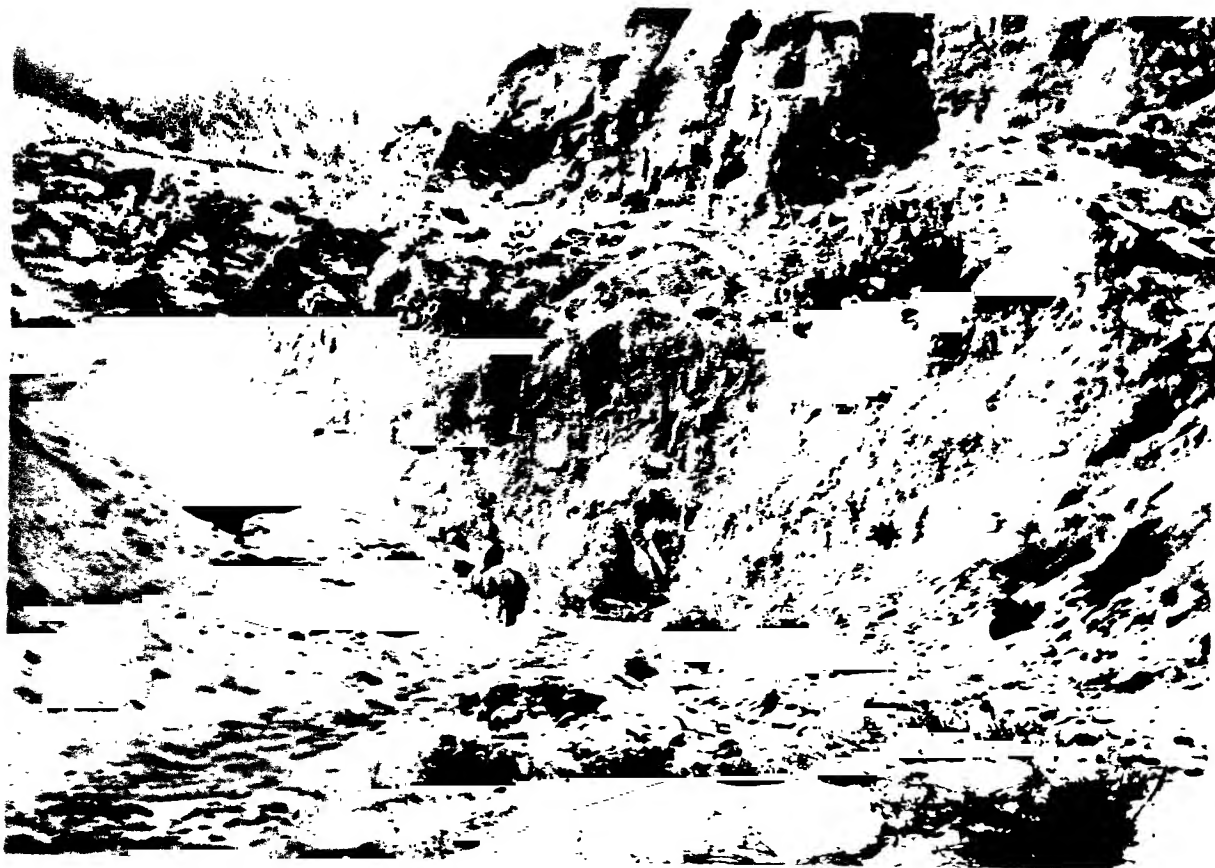
All day we still had the Anambaruin-ula on our left hand, but the range no longer imparted the same impression of majesty that it had done previously, the reason being that we were much too close in to its foot, so that the loftiest reaches were screened by the elevations down at the base. The ground was everywhere covered with snow. It consisted throughout of gravel-and-shingle, gravel, sand, earth, with occasional blocks of stone, but nowhere of hard rock. The hills and spurs which jut out from the mountains actually consist of soft materials, derived from greenstone and crystalline schists.

Leaving the ruined temple, we travelled a short distance down by the right bank of the Davato, and then crossing over it, passed a small range of hills running

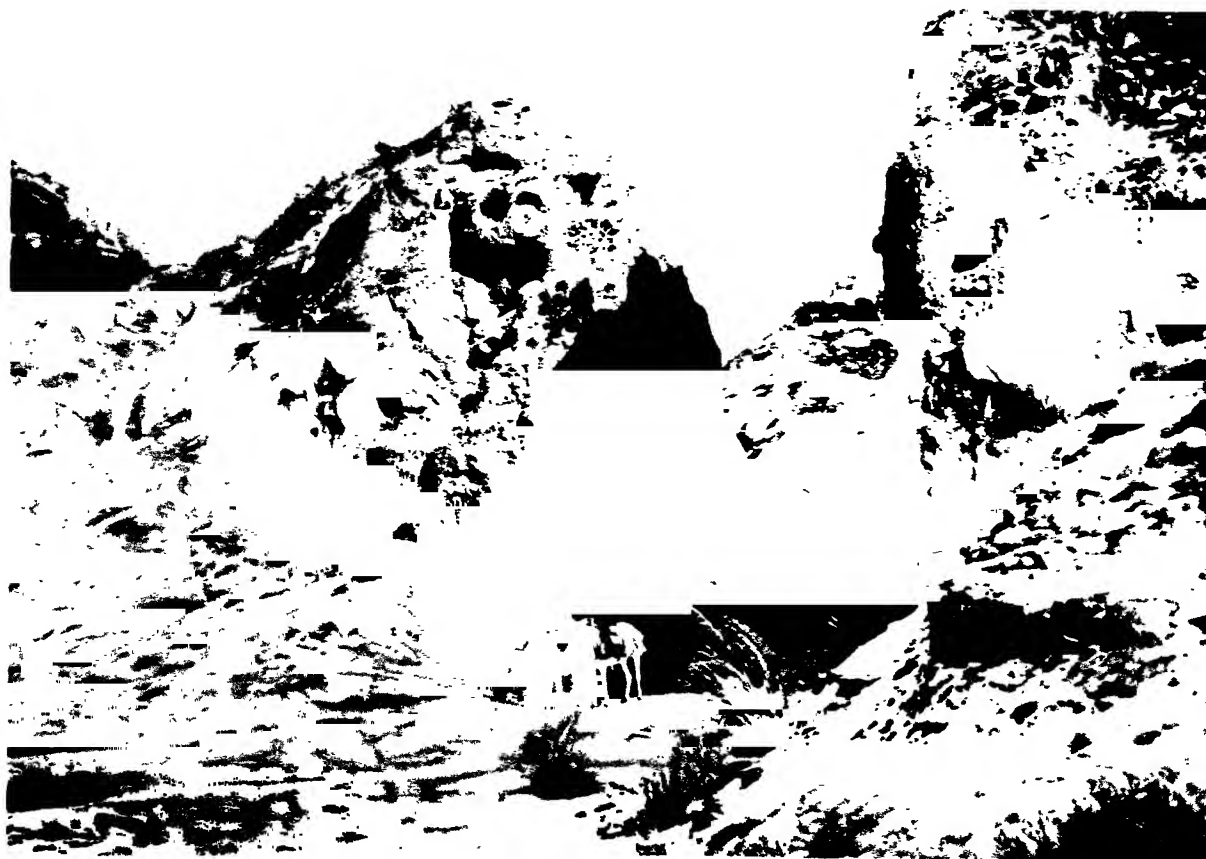
north, and separating the glen of Davato from the next eroded watercourse beyond it to the west, namely Be-schui-tschuen-tsa, of moderate size, and formed by two small subsidiary glens, which united below the track we were following. Generally speaking, it may be assumed, that only those ravines and watercourses bear names which contain springs, and are either used for grazing or are actually inhabited. This was the case, anyway, with the last-mentioned glen, that of the White Water Spring, the upper part of which is also said to afford good grazing; but there is no track leading up it. As the Chinese names in this locality were given to me by Mongols, it is not improbable that they are more or less distorted, even though my Mongol informants themselves understood Chinese. It is however strange that, though the lower ends of these glens are inhabited by Mongols only, at all events at the present time, they nevertheless nearly all bear Chinese names.

In one dry ravine we came across a solitary tent, the owner of which happened to be absent, and so narrow was the space that the tent quite filled the hollow from side to side. It appeared to have been placed there solely for protection against the wind; my guides did not know the name of the ravine. A little lower down in the same hollow we saw yet another tent. The next glen, called Schin-go, was rather large and deeply trenched; in its western perpendicular scarped terrace are two earth-caves, bearing signs of having been recently used. This glen neither contains any spring nor possesses a track in either direction, up or down. A little higher up, there stood on one side no less than ten yurts in a clump; but their only inhabitants were women and children, the men being absent, either hunting or gone to Sa-tscheo. After that came the two large glens of Igo-jempen and Sigo-jempen, that is One Wall and Four Walls respectively, these names alluding to certain ruins, of which only faint traces remain. Just below our track the two glens unite and form a broad, deeply cut watercourse, with a vertical escarpment of gravel-and-shingle on each side. The former, Igo-jempen, possesses a spring and leads up to a pass. An old track, now however seldom used, is said to proceed from the upper part of the glen westwards, crossing the higher reaches of all the larger glens which we had before us during the rest of the day, and finally it strikes the glen of Äksä; consequently it runs along the northern side of Anambar. Sigo-jempen also possesses a spring. The glen of Sa-go, the Mongol name of which is said to be Ike-säto, has a spring in its very highest part; this glen is one of the very largest of all. Between it and Sigo-jempen the surface is furrowed by an endless number of tiny rainwater channels, which were nevertheless irksome and wearisome to cross. Another big glen is Ike-ergetö, which upon reaching our route divides delta-like into three arms (alt. 2540 m.) The next glen bears the name of Lang-scha, so called from a wolf-trap which it contains constructed of stone. After that we skirted the blunted, rounded front of a series of hills, gapped by a number of rather deeply trenched ravines, fairly broad at the top, but narrowing towards the bottom. Amongst these I noted the name of Muchur-davo, which I was told is equivalent to *cul-de-sac*: the path which runs up this glen leads to nowhere. Another name is Dundugol or the Middle River. A larger glen, possessing a very wide, trumpet-shaped outlet, is called Chara-tschiloto, or the Black Stony District. We pitched Camp CXXV in a glen of medium size immediately east of Tsagan-davo (alt. 2551 m.).

By thus crossing over all these watercourses, ravines, and glens at right angles, one naturally obtains only an incomplete conception of their several topographical situations, their feeding areas, and their lower parts. Our Mongols told us however, that all the glens which we crossed in the course of this day originate in the crest of the range which constitutes the eastern continuation of the Anambaruin-ula. This particular range possesses no snow, and can be crossed at intervals by more or less difficult passes. On the other hand the big glens which lie west of Camp CXXV start from Munkör, or the perpetual snows which are heaped up in the central parts of Anambaruin-ula, adorning the loftiest summits of the great mountain-knot. As for the direction assumed by these watercourses down in the lowlands, I was unable to obtain any clear conception. Scho-ovo-tu alone is said to lose itself in the sand, while Davato and Sigo-jempen unite, and so penetrate farther north. The watercourses which we crossed over previous to reaching Camp CXXV are said to concentrate gradually into one main channel, which proceeds towards Tuj-murtu; and to the same district several of the larger watercourses farther west are also said to make their way. However that may be, the surface would seem on the whole to slope away towards the west, although it does so with unexampled gentleness.



THE GORGE LEADING DOWN TO DSCHONG-DUN TSA.



*Illustr. A. B. Lagrelius & Westphal.*

THE OUTLET OF THE SAME.



## CHAPTER XXIII.

### NORTH AND WEST OF THE ANAMBARUIN-ULA.

On 18th January we made a short stage, but the country traversed was uncommonly interesting and picturesque. First we crossed over two chains of hills lying north and south, and separated by a minor ravine, which however was fairly deep. This brought us to the verge of the very large and striking glen of Tsagan-

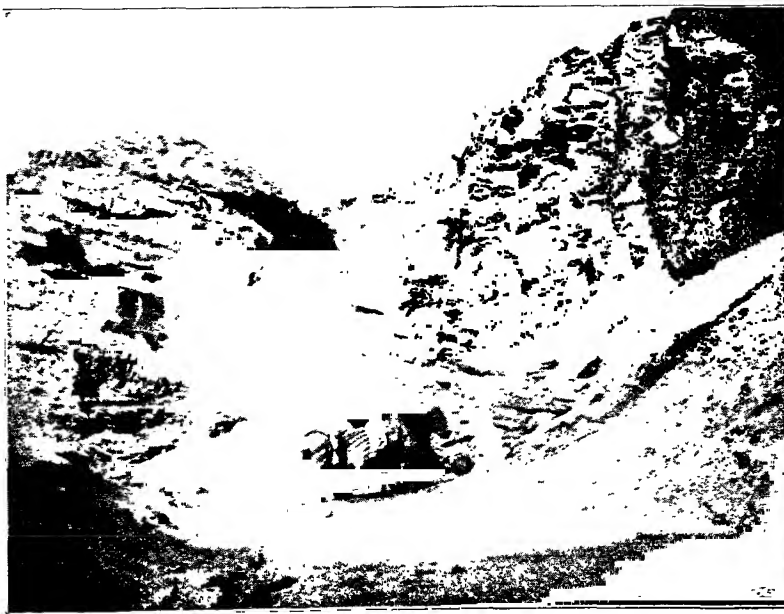


Fig. 287. THE GORGE LEADING DOWN TO DSCHONG-DUN TSA.

davo or Aksä; its great depth, 40 m. on the right side and 50 m. on the left, is rather obscured by its great breadth. Black cliffs form the edge of its left escarpment. On the south, that is up towards the Anambaruin-ula, it pierces a minor range of foothills, and is joined by a side-glen coming apparently from the south-east. It is backed at the head by a great massive, overtopped by several snowy

peaks, and behind that, again, there towers up a domed snowy summit. The road of which I have already spoken, and about which I shall have something more to say presently, runs through a gap, about 4 km. up the glen, on the north side of the snowy mass and south of the foothills. The broad bottom of the Tsagan-davo was strewn with gravel, amid which we perceived signs of copious downflows of water. At that time there was a thin strip of ice in the middle of the channel, beginning beside the track and stretching some distance lower down. Those parts of the bottom of the glen which are not reached by the flowing water consist of soft materials, whereon scrub vegetation was growing. This glen lies at a somewhat lower level than that in which Camp CXXV was pitched. In places the lateral erosion has eaten into the hills that crown the escarpments at the side. This not infrequently gives rise to curious crevices or cracks, both long and narrow; and these may be said to be the characteristic feature of the locality.

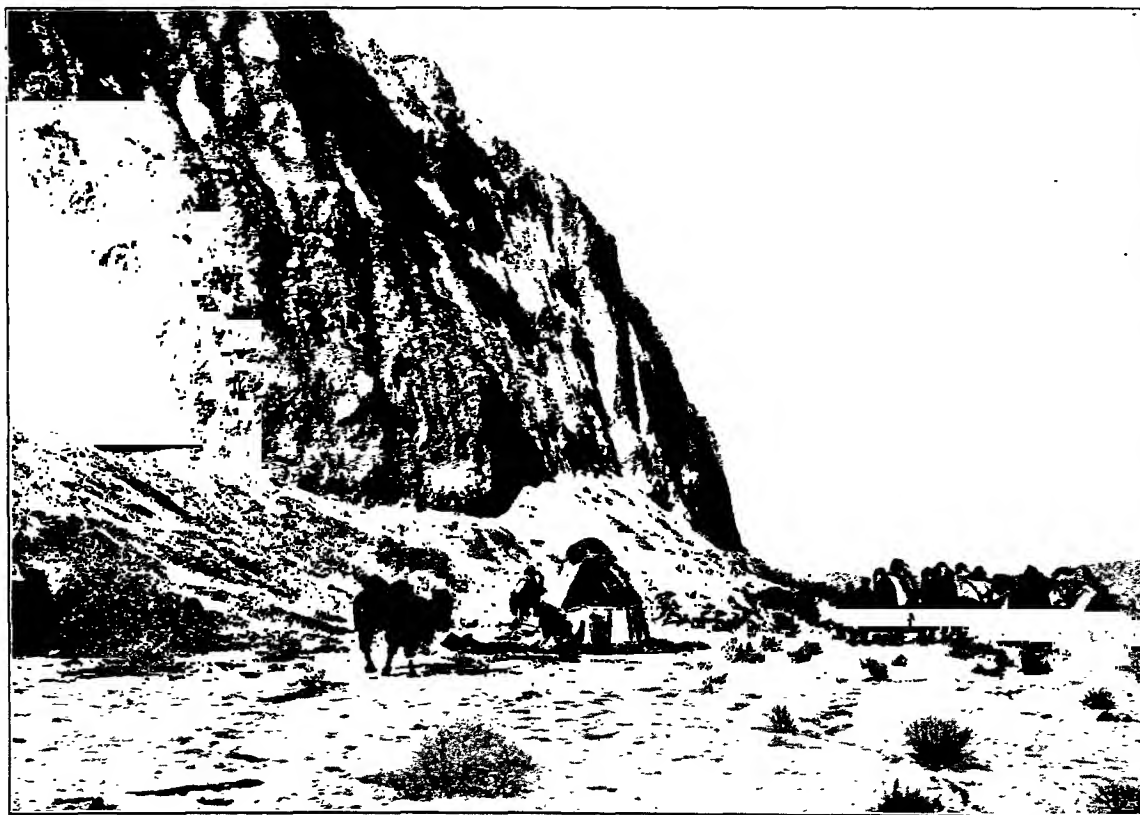


Fig. 288. DSCHONG-DUN TSA.

The mountain slopes west of Tsagan-davo are so exceptionally seamed with watercourses that we crossed over one every minute, or rather should have done so had they not been individually so deep and so difficult that several minutes were required to get across each of them. They anastomosed and separated again, giving rise to an inextricable reticulation; and when we glanced down towards the north, we saw the slopes below us likewise furrowed by a similar network of dark lines.



Yet farther out in the same direction the surface appeared, at any rate to the eye, to be perfectly level and free from hindrances; but our Mongols asserted, that travelling was there impossible because of the ravines, although it is hardly conceivable that the relief could be more capricious or more difficult than it was along the line taken by our route.



Fig. 289. DSCHONG-DUN TSA.

After crossing over a large number of watercourses, great and small, our track, which was now less frequently indicated by pyramids of stone, turns south-west and proceeds up a large glen, which yawns like a gateway in the foothill range. The ascent was rather steep. On our right we had the glen of Dschong-duntsa cut about 50 m. deep through absolutely soft materials, namely gravel-and-shingle and coarse sand bedded horizontally. We gradually inclined to the south and south-south-east, turning into the upper end of a side-ravine, which we followed downwards towards the west; for it was only in this way that we were able to reach the bottom of the Dschong-duntsa. This side-ravine is a gorge or »hollow way«, the bottom of which, choked with débris and stones, descends with a sharp pitch; the walls, which gave back a resonant echo, consist of the usual gravel-and-shingle. They are either perpendicular or even in places overhang, and appear to be altogether precarious, ready at any moment to topple down, especially where they are cleft by gaping fissures. At one sharp turn the water has scooped out a grotto, and in narrow places there would be a similar grotto on each side. This deep,

dark gorge is quite short, but at the last angle the gloom was dispersed and the main glen burst upon us bathed in sunshine, with its vegetation and strip of ice, set as it were in a framework. The ice-sheet, which serpentine north-north-west, glittered a turquoise blue, the snow having been blown off it. Alongside it was a belt of vegetation, and an abundance of balghun bushes; and amongst these, though a little higher up, the water was trickling out of a spring that burst in the bed of the stream. About a couple of kilometers higher up the glen, there was excellent grazing, and there stood a Mongol camp. Traces of several such camps occurred around

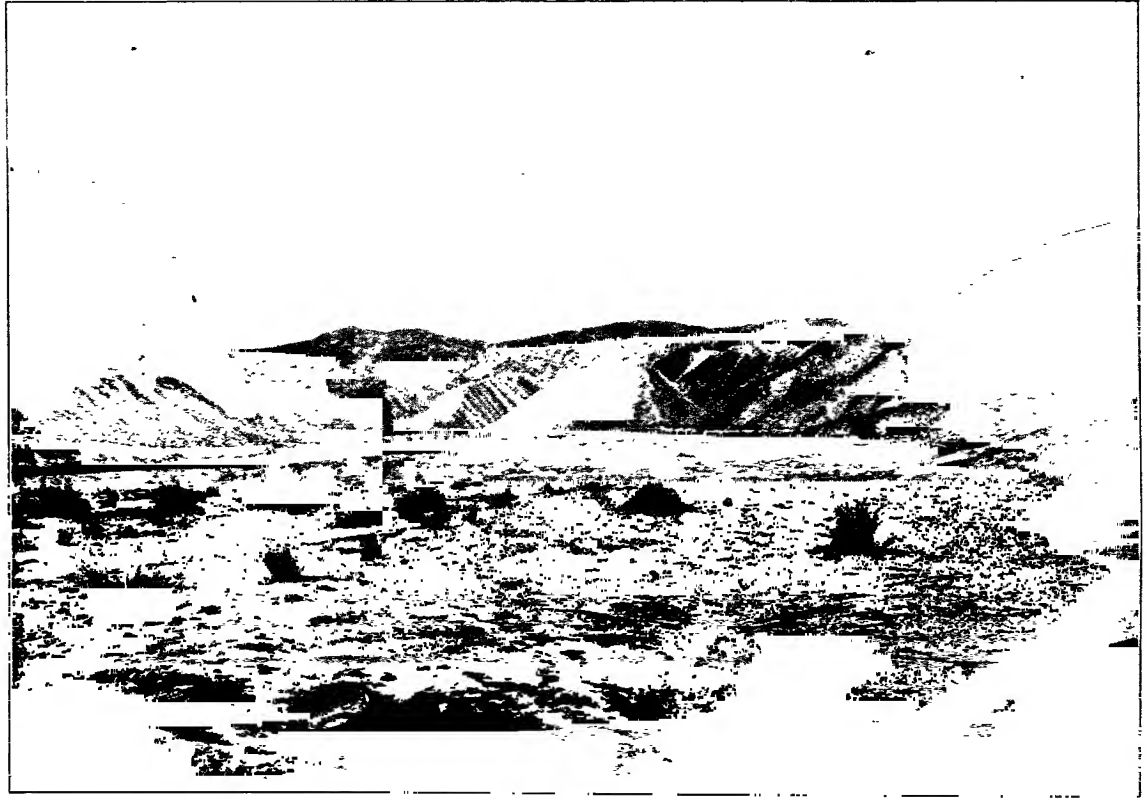
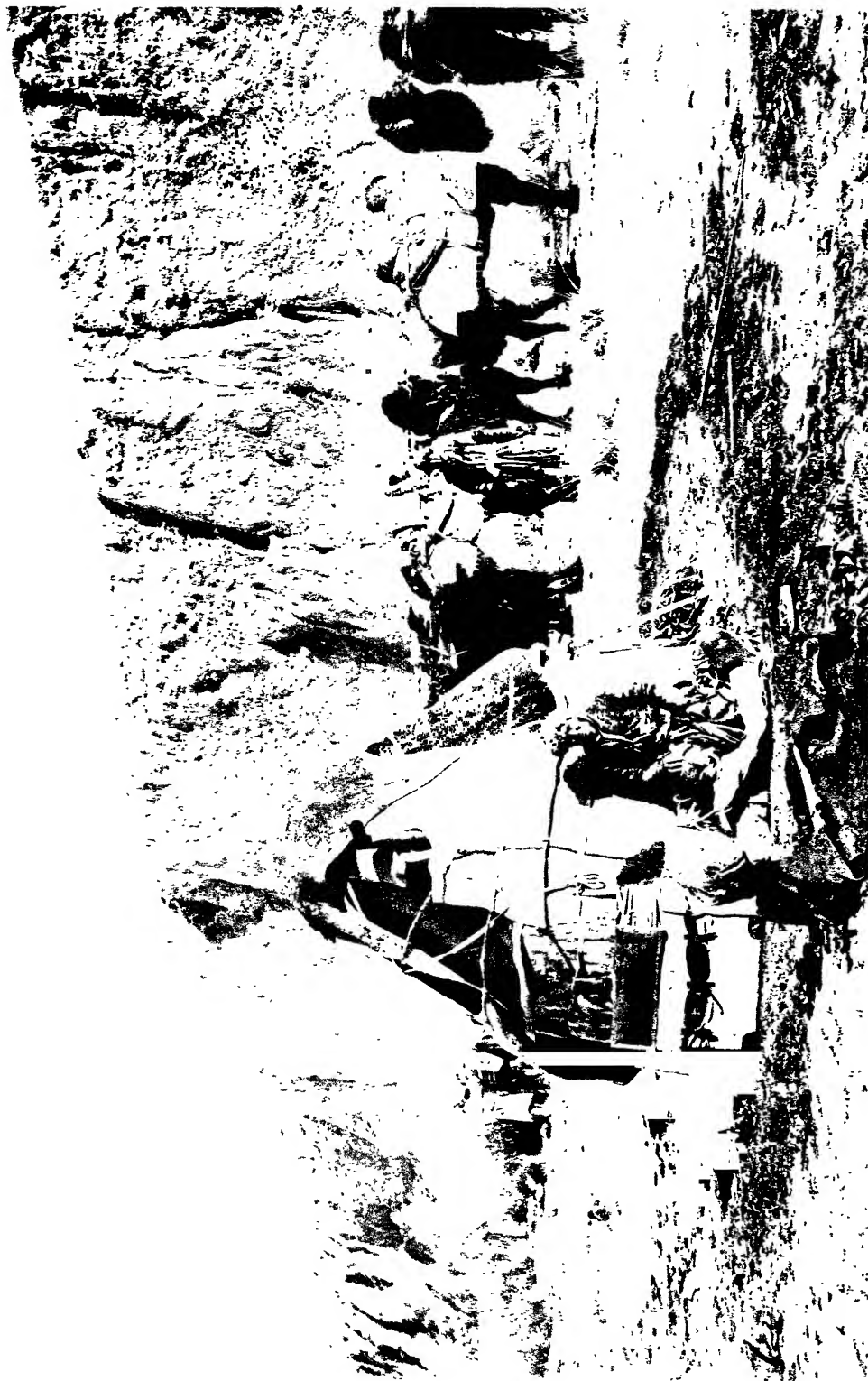


Fig 290. UPPER PART OF THE GLEN OF DSCHONG-DUN TSA.

the spring, and there too we found three fireplaces of brick, with hollows for the cooking-pots and dry fuel stacked around them. Evidently the Mongols intended to return to them soon. At the head of the glen we had the same majestic panorama that we had lately witnessed at the end of the transverse glen of Tsagandavo. Camp CXXVI was made on the left side of Dschong-duntsa, on soft earthy ground (alt. 2591 m.), and in a district which for picturesque beauty cannot be matched amongst these desolate mountains. On both sides it is hemmed in by stupendous vertical cliffs of gravel-and-shingle, sunlit parts alternating with darker parts in shadow, and with gloomy portals gaping wide where the side-glens and subsidiary ravines break through to join it. When seen through this picturesque framework, the grand features of the snow-clad, ice-panoplied mountains, the culminating sum-



*Lieut. A. B. Lucichus & Westphal*

THE CAMP AT DSCHIONG-DUNTSA.



mits of the Anambaruin-ula, towering skywards behind, are rendered still more impressive and striking.

With regard to the upper route mentioned above, I may here add the following information which I received from the Mongols of Dschong-duntsa. They told me, that at Be-schui-tschuen-tsa the track bifurcates, and of its two branches it was the lower one which we had followed. The upper branch, with which the above-mentioned route from Scho-ovo-tu would seem to be united, continues on as far as the Mo-baruin-gol, whence it coincides with our route to Kan-ambal. The upper

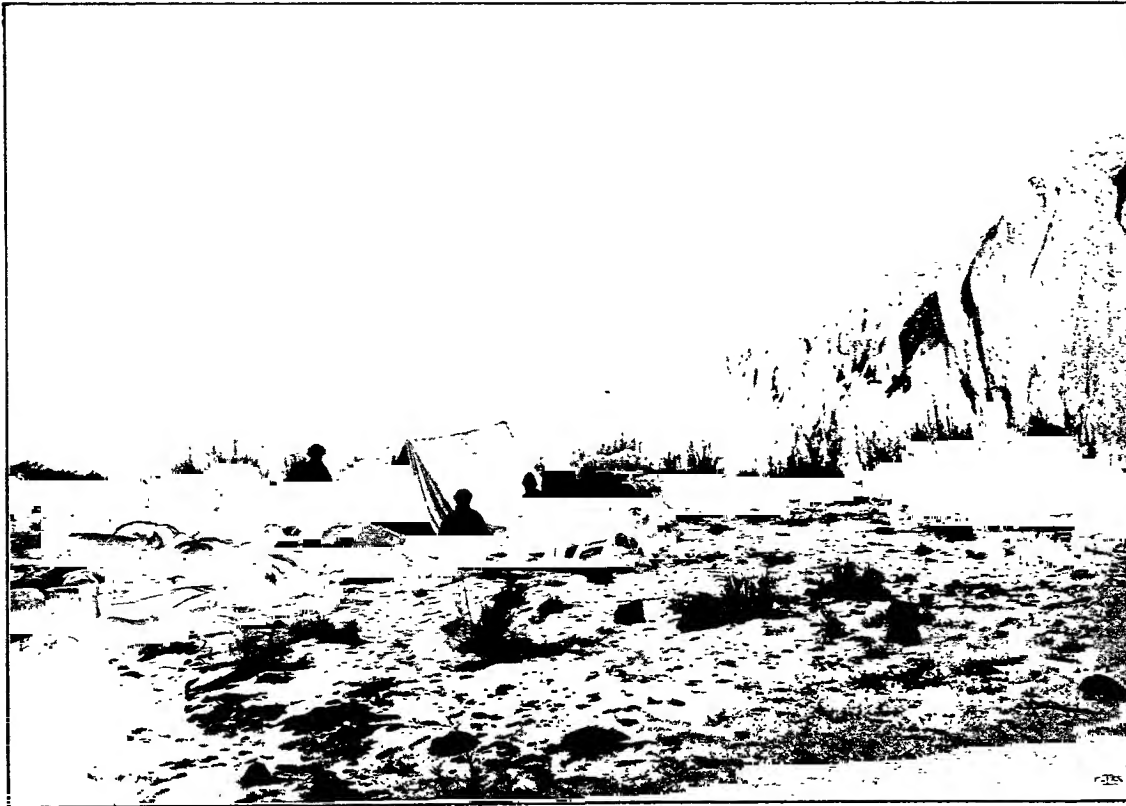


Fig. 291. DSCHONG-DUN TSA, THE RIGHT SIDE TERRACE.

track keeps, as I have said, to a depression close under the northern foot of the Anambaruin-ula, traversing a country remarkable for its abundant grazing, and even for swampy ground. It is visited by several Mongols in the summer; but in winter it is inaccessible because of the vast quantity of snow. The track itself is however anything but easy, for it climbs over a great number of passes, some of them reported to be rather difficult. The upper parts of the Aksä and the Dschong-duntsa are separated by a spur, on the east slope of which, not particularly steep, the springs of Aksä originate and stream down fan-like into the great glen, the lower course of which we were traversing. The western slope however, which belongs to the glen of Dschong-duntsa, is reported to be exceptionally steep, and to be five or six times loftier than the gravel-and-shingle escarpment above our camp, and it was

about 50 m. high. Yaks and horses without burdens are alone able to make their way there. Just under the pass there is a small open space known as Hama-gol, and there bushes exist on both sides of a small rivulet that issues from a spring. Between that point and the spot where our tents stood the glen of Dschong-duntsa is waterless. But in the summer, after rain, the glen sometimes becomes so filled with water that it is unable to find a passage, and the depth to which the bed is excavated is a proof of the energy with which the stream then performs its erosive work. The district above Hama-gol is called in Mongolian Ölken-tänesing, and in Chinese Tscheng-tscheng. From it goes off, to the west, the glen of Tsagan-tschiloto. The upper track is exactly the same distance from Camp CXXVI that



Fig. 292. OUR CARAVAN AT DSCHONG-DUN TSA.

Chara-tschiloto is from the same camp. Between the two tracks comes the chain of foothills, which is said to begin in the district of Sa-go in the form of low hills, but it grows higher and bigger as it proceeds west, and finally comes to an end at Binguin-gol. The numerous passes along the upper track are so confusing that one is strongly inclined to believe, that what I have called a chain of foothills is nothing else than a series of considerable swellings on the northern spurs of the Anambaruin-ula. On the other hand, from the descriptions given to me it is quite clear that the chain in question really is a continuous and connected range running east and west, and parallel with the great main range to the south of it. But only a visit to the higher regions in summer can clear up the orography. Yet even now we may provisionally distinguish between the main range with its summits capped with perpetual snow; the range of foothills which possesses no snow, except for accidental patches, and is moreover pierced by the four great glens of Aksä, Dschong-duntsa, Tsagan-tschiloto, and Lu-tschuen-tsa; and finally, far away

to the north, a stretch of low hills, along the northern foot of which our route was running. With regard to the watercourses that we had to cross over, they may readily be divided into three categories in relation to the three stretches of parallel elevations which I have just enumerated. The greatest of these, namely the four just named, start in the culminating range of Anambar; those of medium dimensions from the range of foothills; while the smallest ravines and watercourses proceed from the lowermost stretch of hills. The following sketch (fig. 306), which is entirely schematic, shows the arrangement.

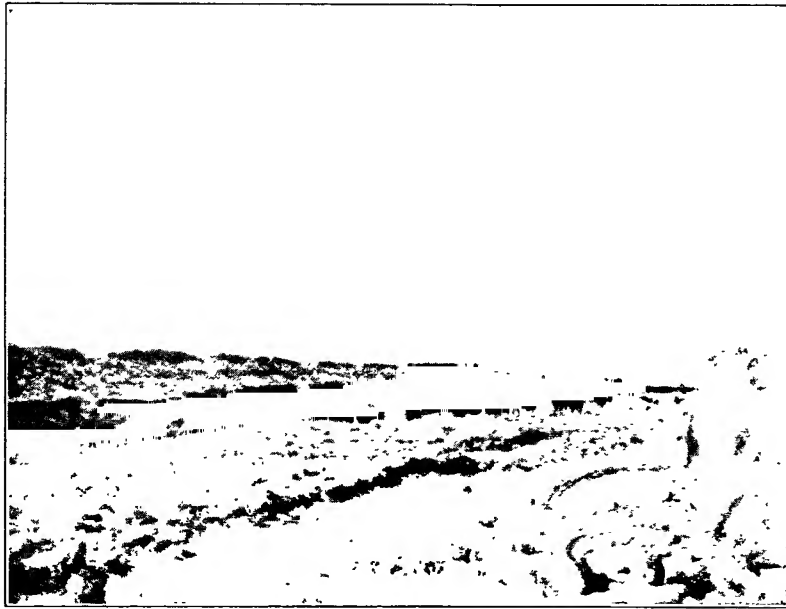


Fig. 293. WHERE ONE OF THE GLENS GROWS BROAD AND SHALLOW.

January 20th. We now rode towards the north-west along the broad watercourse of Dschong-duntsa, which lower down appeared to broaden out still more, having its left eroded terrace immediately on our left hand. The escarpment grew lower and lower; at length, climbing to the top of it, we resumed our journey towards the west-north-west, the surface sloping gently down towards the north, but still continuing to be furrowed by ravines and watercourses, which made it just as tiring, especially for the camels. On this surface gravel is especially abundant, and amongst it grows occasional scrub. So far as we were able to see, the watercourses were at first directed towards the north; then however they seemed to incline towards the west. To the north we perceived a tract of yellow, clearly drift-sand, and to the north-west a minor ridge, one of those that we crossed over later, though we were unable to see it distinctly because of the haze. Every now and again we caught glimpses of the snowy peaks of Anambaruin-ula to the south. It was however impossible to attempt to identify them individually with the peaks which we had noticed from Särtäng. As seen from the north side, they appeared to be more intimately conjoined together. The snow-line seemingly lies higher on the

northern side, though this is probably an illusion, occasioned by the difference in relative altitude between Särtäng and the Gobi. There do not appear to be any similar outstanding peaks to the west of the culminating knot of Anambaruin-ula. Such peaks as do exist in that direction bear streaks of snow only, not continuous snowfields, such as might give rise to rudimentary glaciers. From the *firn* expanses of the great central knot certain small hilly »ice-braes» do indeed proceed, yet they too appear to be of a rudimentary character.



Fig. 294. ON THE SIDE-TERRACE OF A GLEN.

The next transverse glen of the first magnitude is Tsagan-tschiloto, though it is not so big as either Aksä or Dschong-duntsa. From it one can count four parallel crests or ridges to the south, although two of these are but branches or off-shoots of two larger ranges. Portions of the glens of Ölken-tänesing and Ara-tänesing are also visible from the same place, though one can only surmise what is the position of the former, namely that it lies behind the dark ridge. Tsagan-tschiloto is formed by at least two glens containing springs, and these unite at the point where we crossed over the system.

After that the slopes of the mountains still continued to be scored by countless numbers of small watercourses and rivulets, tiring to travel over. We nowhere observed hard rock, nothing but gravel-and-shingle detritus, grey granite, striped granite, gneiss, several varieties of mica-schist, quartzite, crystalline schists, greenstone etc.; fragments of stone of rather large dimensions were not at all uncommon. In the larger transverse glens we generally saw, about a couple of kilometers higher up than our route, very steep mountains of a red colour; judging from their shape they consisted for the most part of the accumulated products of disintegration. And it is from this circumstance that the next large transverse glen derives





MOUNTAINS AT LU-TSCHUEN-TSA.



*Ljustr. A. B. Lagrelius & Westphal*

CAMPING AT LU-TSCHUEN-TSA.



its name of Ulan-gol or the Red River. This is broad and filled with gravel, through which run several water-channels; the glen itself is formed by the convergence of several glens coming from different directions.

After that we crossed over Gang-go, a pretty considerable glen of the second rank, that is it does not start from the main range. I was amazed at surprising in this glen five wild camels, namely a *bughra* (male) and four she-camels. Upon being shot at they fled northwards down the glen, but nevertheless stopped within sight and began to graze again. During the course of the day we perceived in the snow numerous tracks of wild camels, proving that the animals were then up on the good grazing-grounds and amongst the snow-drifts. The amazing thing about this is, that the wild camel, which in other districts where I have come across him, is so exceedingly shy and cautious, should here, at the northern foot of the Anambaruin-ula, be so bold, and entertain so little fear of the human dwellings in the vicinity.



Fig. 295. THE CAMELS EATING SNOW.

After crossing over the glen of Scho-li-go, which also is of secondary rank, we travelled south-west, making for a small threshold, which afforded a glorious view of the large glen that lay immediately to the west of it, namely Lu-tschuen-tsa, quite a refreshing sight amid the everlasting grey of the stony landscape. In its bottom was a sheet of ice, in part glittering bright, and blue, in part covered with snow, with open rivulets trickling along here and there. There was any quantity of high, thick, yellow grass, as well as bushes and thickets, and, what was better than all, a couple of groves of small willows on both sides of the river. After seeing this beautiful oasis I was no longer surprised that the Mongols should prefer Lu-tschuen-tsa to Kan-ambal. Here too we discovered the ruins of seven stone houses; only a very small portion of the plaster on their interior walls was still remaining. On the left

terraced bank were some cultivated fields in a very good state of preservation. They are arranged in terraces on an amphitheatrical plan, in such a way that the stream of water, which was led off from the river by means of a canal arm, watered first the top patch, and after that flowed down to the next below it, and so on. The low walls through which the irrigation water made its way by small gaps bore plain indications that it could not have been long since these fields were cultivated. On the right bank there is a miniature Chinese temple. The vegetation from which the place derives its name of the Willow Spring covers but a very small space. The



Fig. 296. ON THE ICE OF THE LU-TSCHUEN-TSABROOK.

glen appeared to come down from the S.  $25^{\circ}$  E., and to proceed onwards towards the north-north-west, to the above-mentioned Tuj-murtu, distant a long day's ride on horseback. From the neighbourhood of the spring, where we encamped, the upper road was stated to be exactly as far as Dschong-duntsa is from the same spot. In fact where the upper road crosses over the Lu-tschuen-tsa (2441 m.) the latter is very narrow and difficult of access, being choked with big blocks of stone. The springs which feed the glen stream are situated close under the edge of the perpetual snows, so that it is just as impossible to cross over the Anambaruin-ula here as it is by any of the glens farther west of Davato. Passes there indeed are, but they are impracticable, as well as superfluous, for it is possible to



*Ljustr. A. B. Lagrelius & Westphal.*

RUINED TUNGAN HOUSES AT LU-TSCHUEN-TSA.



make a circumambulation of the entire mountain-mass without any very great loss of time.

The glens of Dschong-duntsa, Tsagan-tschiloto, Lu-tschuen-tsa, and Holustä are said to meet together and give rise to a common drainage artery about 10 km. south of Tuj-murtu. This watercourse is reported to cross over not only a minor belt of sand, but also the small mountain chain which we saw at a distance, and which forms an eastward continuation of the mountains that we climbed over on the north of Kan-ambal. But the oral descriptions that were given to me in this connection are not altogether reliable. From our route there appeared to be two small parallel ranges running towards the east-north-east. Their position would seem to indi-



Fig. 297. MOUTH OF LU-TSCHUEN-TSA.

cate that they probably belong to the same system as the two desert ranges which I crossed over when making for the Kuruk-tagh; though these are not indeed continuous, but are gapped in two or even more places in the same manner as the little ranges are that we saw to the left whilst on the road to Atschik-kuduk. Possibly the large drainage-artery alluded to makes its way out through a similar gap. The mysterious district which my Mongols called Tuj-murtu would appear to be situated to the north of the small desert-ranges. After heavy rains the water is said to descend as far as the locality in which we then were. The stream of Lu-tschuen-tsa in particular, which appears to originate in the very loftiest regions of the Anambaruin-ula, is said to swell in summer to a really imposing flood. In the matter of wind, this present locality is unlike those which we had previously visited at the northern foot of the Anambaruin-ula: gusty winds of a föhnal character are stated not to occur here at all. Strangely enough, the prevailing wind in the spring is said to come from the north-west, quite the opposite direction to the prevailing wind of the Lop region. At that season sand-storms sometimes occur, and on such occasions

the air becomes to that extent charged with dust and sand, that it is impossible to travel, and everybody has to halt wherever they happen to be.

I was told that it was only three years since this locality ceased to be cultivated. The oldest man amongst my guides recalled that some fifty or sixty years before five or six Tungan families had been settled there; but they fled when the first great Tungan revolt broke out, for they were unwilling to make common cause with the insurgents. Near our camp were the remains of three houses, and a little higher up the ruins of five others, all said to have been built by Tungans. Probably the ruins of Kan-ambal date from the same period. At the present time the glen of Lu-tschuen-tsa is visited in certain years by Mongol nomads, who pitch their



Fig. 298. ICE ON THE BROOK OF LU-TSCHUEN-TSA.

tents in the vicinity of the ruins; the years when they do not visit this glen they remain in Särtäng. The following tradition is connected with this place. Parts of the ruins and ancient remains which we found there are said to date from the distant period when the Mongol chief Dandschin Kan Tädsche was at war with the Chinese. He had preferred a request to Bantschin Bogdo (Pantschen Rimpotsche) in Taschilumpo, that he might be the ruler over the Mongols; but when his desire was refused, he proceeded with his warriors and picked fighting-men to Si-ning-fu and seized the town. The Chinese then called upon him to yield the town up to them, but he replied that he intended to hold it as long as his provisions lasted. When his supplies were exhausted, he cut his way out, and went to Anambaruin-ula, Lu-tschuen-tsa, and Kara-schahr. After this the priest in Tibet promised him, that at the end of 360 years he should be reincarnated and be the ruler over the Mongols, an event which is believed to have happened a hundred years ago. Anyway my guides were convinced that the stone walls which we saw dated from those troublous times, and so also did the names Igo-jempen and Sigo-jempen, the One Wall and the





CAMP AT LU-TSCHUEN TSA.

*Inset, L. E. Logsdon, & W. E. Phelps.*





*Lynceus, A. B. Lacustris & H. estival*

ON THE ICE OF THE BROOK OF LU-TSCHUEN-TSA.



Four Walls respectively. What amount of historical truth there may be at the bottom of this tradition, current amongst the Mongols, I am unable to say.

On 21st January we rode through a country that was cut up with ravines and watercourses to yet an even greater extent than hitherto; it was excessively tiring and trying to the patience of our loaded caravan. The ground was everywhere strewn with coarse detritus and fragments of stone, some lying on the surface, others uplifted on a sort of pedestal of hard sand, which resists destruction, while the softer material all around it is washed away. Our route led towards the north-west, west-south-west, and west. The belt of vegetation and the ice-sheet of Lu-tschuen-tsa both came to an end a little way below our camp. After that we kept



Fig. 290. AT LU-TSCHUEN-TSA.

to the right terraced bank, the track being good so long as we continued parallel with the watercourse. At length we crossed over the watercourse, which appeared to stretch a long way towards the N.  $10^{\circ}$  W. To the N.  $5^{\circ}$  W. we perceived a westward promontory of the nearest little desert range, whilst its eastern extremity was visible to the N.  $40^{\circ}$  E. Still farther towards the north-east we saw smaller groups of mountains, though faintly outlined like mist. Quite close to the westward promontory I have mentioned the Lu-tschuen-tsa glen appeared to intersect the watercourse we were following, and after that it appears, as I have already stated, to break through the more northerly and rather higher of the two desert ranges.

What forced us to turn to the north-west was a fairly large spur of the Anambaruin-ula, though it was built up entirely of soft materials. Its position was immediately west of Lu-tschuen-tsa. When it at length terminated, the road, marked at intervals by cairns of stones, curved round to the west-south-west and, sedulously following the contours of the mountains, wound backwards and forwards a thousand times or more. Evidently the eroded watercourses are easiest to cross over just at

the points where they break out of the mountains. Below that they begin to converge and join together, and the power of the torrents, thus augmented, results in a more energetic erosion.

Turning out of the glen of Lu-tschuen-tsa, we crossed over a small secondary threshold and water-divide, and then kept along the edge of a minor watercourse, which, after following the base of the mountains for some distance, terminates in a perfect labyrinth of deep, wild ravines with perpendicular walls — nothing but gravel and pieces of stone, grey and desolate, yet withal picturesque. At the first glance,

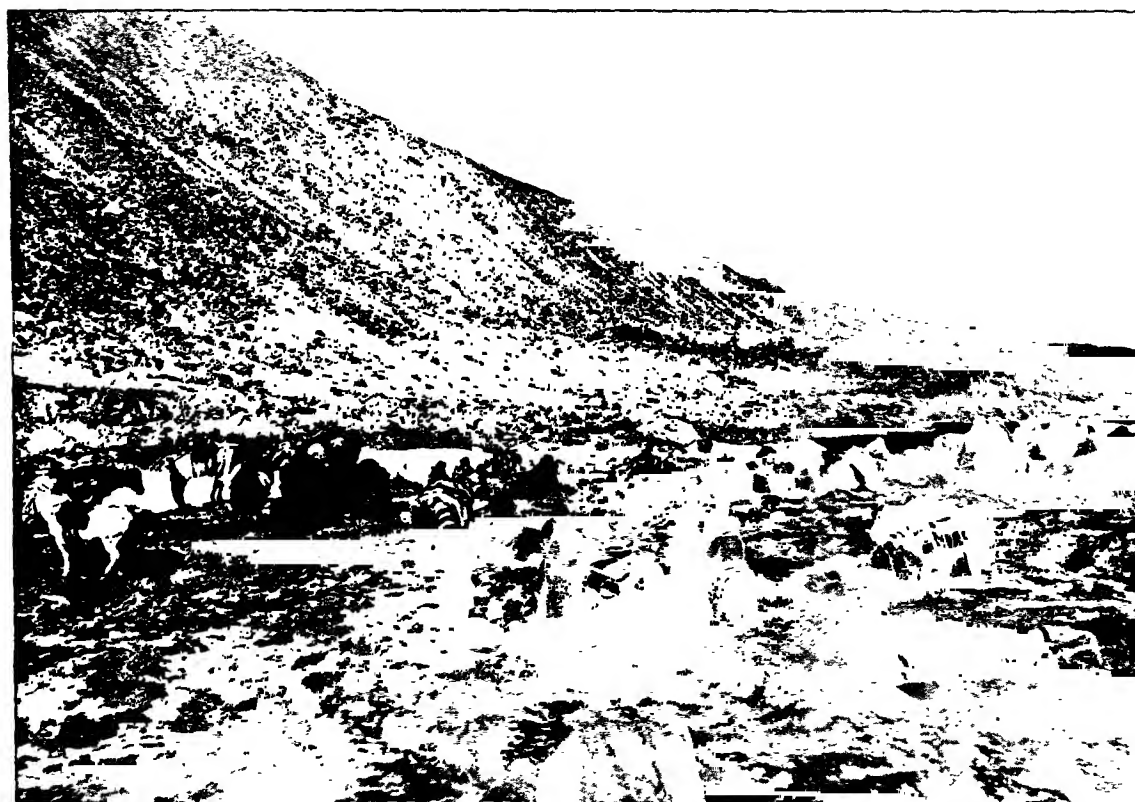


Fig. 300. FROM GASCHUN-GOL DOWNWARDS.

it looked to be a sheer impossibility to get camels across these deep gorges, carved through the gravel-and shingle, and yet we did succeed. This locality is known as Gang-go. Once across, we pushed on up the left bank of the watercourse, towards the south-west, the route being again for a short distance relatively good. This watercourse hugs closely the foot of a precipice, through which burst a number of small gorges and ravines, deep, steep, and fantastic, all ending in Gang-go, and like it all filled with detritus. Next we crossed over a series of ravines, some small, some of medium size; one of these also bears the name of Gang-go. Another, known as Otun-go, is particularly deep and difficult, and is provided with triple terraces, while its bottom is filled with stones and gravel. There too we observed a number of dry pieces of willow: these grew in an expansion of the



*Unstr. A. B. Larychus & Westphal.*

GASCHUN-GOL WITH ITS FROZEN SPRING, VIEW LOOKING UPWARDS.





glen one or two kilometers from our route, in a locality in which again traces of former cultivation exist. The next name is Kain-go, a large and broad watercourse. After that we passed on our right a considerable swelling of the surface and, traversing broken ground, approached the entrance to the deeply trenched and narrow glen of Gaschun-gol, in which there was a spring yielding water slightly saline. As usual, it had given origin to a sheet of ice and for a short distance, though for a short distance only, afforded nourishment to good and abundant vegetation. The glen has a wild and gloomy aspect, being a true gorge ensconced between walls of granite, heavily streaked with bands of black and grey. The detritus throughout this district consists in part of granite of every conceivable variety, in part of other crystalline rocks. The altitude is 2274 m.

Here again in the vicinity of Gaschun-gol we surprised a troop of 16 wild camels, three of them bughras, the others she-camels. They were peacefully grazing in company with a dozen kulans.

On 22nd January there was a violent gale in the glen of Gaschun-gol, the wind coming capriciously in gusts and squalls. After crossing over a flatter swelling, we marched south-west up the rather large glen of Da-le-go, its watercourse broad at its lower end, and then over a couple of ridges, as high and steep as the walls of a fortress and running towards the north-east. From its western side one can reach the lower part of the glen known as Holustä (or Holustaj); which in its turn is joined by other side-glens and thus forms a principal glen, that does not appear to unite with Da-le-go. In this glen the brooks from the spring of Holustä had formed an extensive sheet of ice. Beside this brook we made our way up, bushes, grass, and thick kamisch growing on both banks; it is from this circumstance that the glen gets its name. Notwithstanding the cold, the brook was only frozen in the expansion of the glen. Camp CXXIX (alt. 2407 m.) was formed near the walls of a stone house, while a canal, carried along the hills on the left of the glen, had been used to irrigate the wheat-fields. Some thirty years ago four or five Tungans are said to have spent the warm season of the year here, cultivating wheat and barley. The spring of Holustä was situated just above our camp. The watercourse of Holustä as well as that of Da-le-go both descend to Tuj-murtu; indeed the brooks from over a wide area all appear to converge upon that place as into a funnel. This is looked upon as a very windy region, especially in the winter and spring; at the time of our visit the wind was blowing from the west-south-west. At length we found hard rock again, at the entrance to the glen, but it was excessively weathered and friable, and consisted of striped granite or crystalline schists; while at the camp we had black crystalline schists with white veins and crystals.

From this point, which Littledale calls Holosetagh, my route coincided with that traveller's as far as Kan-ambal. On the Russian map we find the names of Cholustin-su and Cholustan-gol. Its Choptschik was not known to my guides. One of the watercourses east of Holustä it calls Tumirtu-gol; this is identical with Tuj-murtu, and possibly it does as a fact designate the united stream that runs down to the lowlands.

The violent gale continued all night and all day on the 23rd January. The mountains were shrouded in clouds, and at 2 p.m. it began to snow softly, and so

continued for an hour. In the country that we then proceeded to traverse there was a considerably greater quantity of snow than hitherto. The track was much better, and it was only at the beginning of the day that we had any ravines to cross over, and they ran down to Tuj-murtu. To the north, we saw in the nearest desert range a gap known as Dava-go, lying to the west of Tuj-murtu. A broad, shallow glen, with an abundance of vegetation, is called Bing-go. After crossing over a minor spur running towards the north-west, we came down into the glen of Lu-schui-go. After that we descended for a good bit across favourable ground, sheeted with snow. Immediately on our left we had the mountains, with their wild crags and cliffs and capricious glens. Here too we were able to distinguish apparently



Fig. 301. THE PLACE WHERE SNOW WAS FOUND IN THE KURUK-TAGH (SEE VOL. II P. 108).

two different crests. We now crossed over the lowest point of the entire region, namely a broad watercourse, into which gather all the drainage channels of the locality. After that we again ascended towards the south-west, going up by the glen of Ma-chung-go, pretty big and distinctly outlined. This led us to the south. On our left, that is to the east, rose craggy spurs of notable dimensions, and on the opposite or western side smaller, detached groups of mountains. We saw the upper part of the Ma-chung-go to the south-east. Farther towards the north this is reported to be joined by the Lu-schui-go, and then to unite with the Bing-go, and finally to enter the Dava-go.

The track soon quitted the Ma-chung-go, and climbing up to a small threshold, proceeded to ascend a little side-glen to the west. Once more we turned our faces towards the south, the mountains receding somewhat on the left, though we were unable to see them clearly for the blinding snow; while to the north-west we perceived the nearest little chain of foothills. The next watercourse is called Er-to-schui; it is rather shallow and insignificant, and possesses not only scrub vegetation, but

also, somewhat higher up in its bed, a spring. We now proceeded south-west across very level or gently ascending ground. The country was open. Two or three smaller hills here are known as Do-sän-tsä. In front of us we had the mountain-ranges which embrace between them the Anambaruin-gol. Camp CXXX was pitched in the vicinity of the glen and watercourse of Sa-go (alt. 2809 m.). On two separate occasions we saw troops of wild camels, consisting of 15 and 20 head respectively. The latter troop were in the glen of Er-to-schui at about two kilometers from our route. Upon the approach of danger they always fly towards the desert, not up into the mountains, where they might be ambushed. From the numbers that we found at the northern foot of this mountain-knot, the wild camel would seem not to be disturbed there in winter by the Mongols.



Fig. 302. A MONGOL OF ANAMBARUIN-ULA.

One of the left-hand side-glens of the Ma-chung-go, not visible however from our route, is said to be called Niu-li-go. Towards evening the atmosphere cleared, and we saw south and south-east from our camp magnificent snow-capped mountain-masses glimmering white and steel-blue. We had now reached a more desolate part of the region: there were no longer either bushes, grass, or springs, only scrub, which supplied us with excellent fuel, though with only wretched grazing. In place of springs there was snow. During the course of the day we several times passed hard rock in the headlands and buttressed spurs. The rock was grey granite, brittle and weathered, black mica-schist, and light micaceous granite.

The 24th January was our last day's march before reaching Anambaruin-gol or Kan-ambal. Our course was first to the south-south-west and then to the west-south-west. The wind blew hard against us, and the snow was decimeters deep, being heaped up in veritable drifts in the ravines and watercourses. While on the



Thus within a very short space the contour drops 594 m. We may safely assume that this transverse glen is narrow, steep, and wild. Here, and extending a long way down the watercourse, there was a gigantic blue-green ice-sheet, swept clean of snow, and entirely filling the space between the scarped terraces. It sloped towards the N.  $7^{\circ}$  W. About a hundred meters from its left bank is a low threshold, on the other side of which a relatively well-grassed glen proceeds towards the north-west. In the same direction we now saw distinctly the nearest of the little desert ranges. Ascending a minor side-glen, we reached a small pass (3095 m.), lying entirely amongst soft material and forming a flat water-parting. From it we went down to Kan-ambal through the same broad valley, bordered with low, rounded heights, the end of which we had passed on our left on the journey out. There can be no doubt it was by this valley that Littledale travelled. The grass here was good. The watercourse keeps close to the northern foot of the mountains, the path leaving it for the most part on the right. The stretch of mountains which here separated us from the Desert of Gobi, and which is pierced farther west by the Anambaruin-gol, was called by my Mongols Hun-to-jor. The upper stone walls, which are reported to be called Schan-jempen, were hidden from us by a small buttress of the mountains known as Chara-udsur. My Mongols also told me, that two small side-glens, which come from the south and enter the Anambaruin-gol at Kan-ambal, are called Schi-tschuen and Che-go respectively. They run parallel to one another, and in the former is a spring, with an ice-sheet. A third glen is called Bandscha; it descends from the little pass of Schi-lang-to which we crossed over on the 1st January. From the minor pass that we crossed over this day we obtained an excellent view of the lower expansion of the Anambaruin-gol. Upon reaching our former camp we found nothing altered, except that the snow lay fairly thickly in the valley. We learned subsequently that this district is occasionally visited by Mongols. The summer before none had visited it, although the previous winter and spring ten yurts were pitched there for the space of 6 months, and after that the people had returned to Särtäng by the route that we followed on our journey out. Some ten or a dozen years earlier a Chinaman had occupied the stone huts which we saw lower down in the transverse glen, and with the help of two labourers he sowed barley and wheat. The locality is said to be notorious for its violent and sudden winds, though they will not bear comparison with those farther east.

The only travellers whom we met throughout the whole of this great circular tour round the Anambaruin-ula were two Chinese, whom we met on this our last day; they were in charge of a caravan of 10 camels, conveying dried fish, packed in large bundles and bales, from Abdal to the merchants of Sa-tscheo. I had never heard speak of this little local traffic in fish, a commodity the Chinese are very fond of, and it is to this chance meeting that I owe my knowledge of it. The reason why the Chinamen choose this lower mountain road rather than the incomparably shorter and more convenient desert route, which can very easily be traversed by camels in winter, is of course simply and solely the grazing and the springs. This traffic can naturally only take place in winter, when the fish are frozen. The two Chinese said that they had been to Lovonur; which proves that at any rate some of them, less well versed in the ancient geography of that region, do apply the classic name to the Kara-koschun as well.

This concludes my description of the geography of the Astin-tagh system and that of the Anambaruin-ula. I propose in the fourth volume to return to this subject, when I will attempt to give a general review of the orographical structure and the relations of altitude. Here I will only point out, that I found the Astin-tagh system to consist of at least two parallel ranges, each successively forming the water-parting and dividing-line between Tsajdam and the Desert of Gobi. The Anambaruin-ula consists of a very massive range, crowned with perpetual snow, with, to the south of it, a minor chain considerably shorter than the main mass. On the north too it is accompanied by a less regular range of foothills, though from the route that we followed they were not very distinct. In the extreme east, where we crossed over it, the system consists of a single and relatively low range.

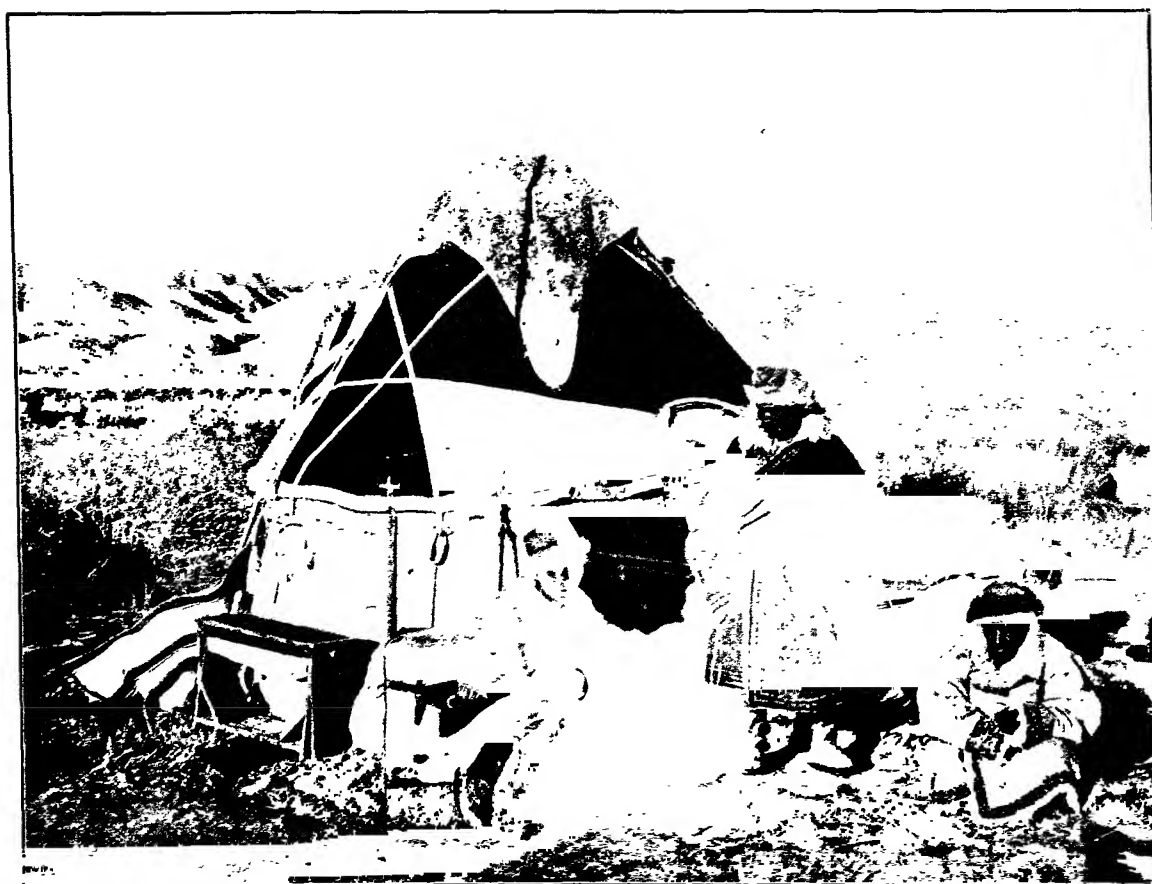


Fig. 304. MY TENT AT KAN-AMBAL.

For the purpose of carrying out a thorough exploration of Anambaruin-ula, it would be necessary to have a fixed base of operations either at Särtäng or at Satscheo, whence one could, with the help of trusty Mongol guides, penetrate into the hidden glens and byeways of this great mountain-mass. The names which were given me during the return journey along the northern foot of the mountains are reliable enough, although I cannot answer for the Mongol pronunciation of the Chinese,

this being a language I am not master of. On the other hand I had no guide along the southern foot of the mountains, and the attempt to allocate names there from Särtäng or from the northern route did not prove feasible; consequently I have only entered one or two which appeared to me to be sufficiently trustworthy. The same remarks apply to a number of names west of the Anambaruin-gol; these too I am unable to enter upon my map, although they prove that the Mongols possess names for the glens and passes in the eastern Astin-tagh, at any rate as far west of the Anambaruin-gol as their migrations extend. Thus the Hong-lu-gu is said to be the name of a small glen situated east of the little pass of Schi-lang-to; Littledale calls it Kong Lugu. Schinne-kötel is a pass in the southern range east of Ja-ma-tschan, across which a track leads to Särtäng. Sa-lang-tsä is the name of a place where gold is found immediately east of Ku-schui-cha, where occur sand-dunes, bound together by vegetation. Hu-du-so is reported to be the name of a district in the eastern Astin-tagh, and the southern range there is known as Tsagan-ula, while the mountains south of Sa-tscheo are called Nan-sän (Nan-schan). The spring which, on the authority of my Mussulman guides, I have called above Ja-ma-tschan, was called by the Mongols Ja-ma-tschen-tsa.



Fig. 305. THE DUNDE-HALGA, AS SKETCHED BY A MONGOL.

Finally I append here a sketch executed by one of my Mongols, and representing the Dundehalga, or Middle Road, alluded to one or twice above. It is called the «middle» road because it lies between the southern route which we followed from Kan-ambal to Särtäng and the northern route which we followed from Scho-ovo-tu to Kan-ambal. The sketch shows that portion of the route which runs westwards from Davato, having on the left, that is to the south, the great main range and on the north the foothill range. Its course was described to me in the following terms: — After Davato comes a glen called Sa-go; then over a little pass one reaches Tolang, a tract of low hills, separated on the other side by a second and easy pass from Aksä. After that comes Nan-tschen, or the Southern Spring, Chara-tschiloto, and the pass of Chara-kötel, from which point the foothill range assumes larger dimensions. The glen of Tsurtauin-gol enters that of Dschong-duntsa, but between the two lies a pass. Then, after yet another pass, comes Hama-gol and then the pass of Hodschanekötel and Ölken-tänesing. Further there are Tsagan-tschiloutuin-

gol. Højte-sala, Lu-tschuen-tsa, the pass of Huntsovaguin-kötel, the Chinese name of which is Choang-tso-va; then the mountainous region of Ulan-tologa. The glen of Choang-tso-vaguin-sala joins that of Bing-go, and into this also enters, from the left,

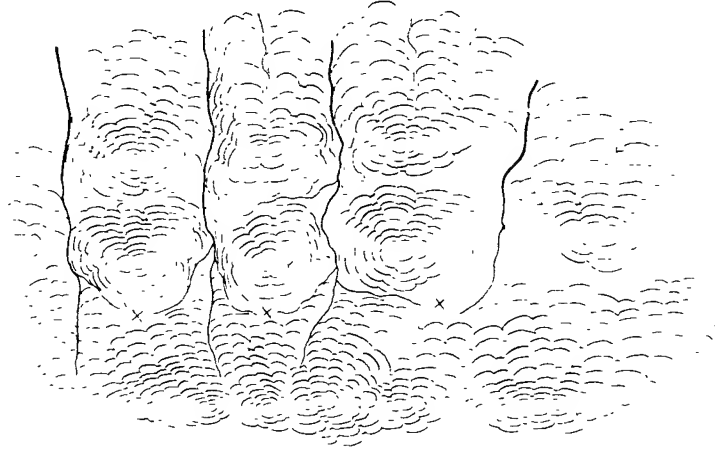


Fig. 306. OROGRAPHICAL SITUATION TO THE NORTH OF ANAMBARUIN-ULA.

that is the west, the glen of Sching-go. Beyond that come the glen of Niu-to, Ma-chung-go, Nukun-bure, Er-to-schui-tsa-le, the pass of Kōkō-kötel, Er-to-schuiguin-gol, Sa-go, Ga-tschuen, and finally Tsching-batse, where the upper road joins the track that we followed. Here therefore the foothill range comes to an end; and as for the main range of the system, we have already ascertained that it is pierced by the Mo-baruin-gol not very far south-west of Tsching-ba-dse.

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# A NEW JOURNEY SOUTHWARDS





*Ljuts. A. B. Lagrelius & Westphal*

TSCHARKLIK, THE START OF OUR CARAVAN FOR TIBET.



## CHAPTER XXIV.

### UP THE TSCHARKLIK-SU TO THE KUM-KÖL.

In the preceding chapters I have described several parts of the great double range of mountains that form the southern boundary wall of the country of Lop. It only remains now to describe yet one more journey which I took across these North Tibetan mountains from north to south.

The starting-point of the great journey which I now began was the little town of Tscharklik, which at the present moment seems to be enjoying a wave of prosperity, the Chinese authorities doing all in their power to attract people to the place and to make it *abad*, or »inhabited». Whilst discussing the Lop villages and fishing-stations along the lowest part of the Tarim, we have seen that a large proportion of the inhabitants spend the warm season of the year at Tscharklik, sowing and reaping. The Chinese are awake to the fact that for defensive purposes Tscharklik is possessed of a certain degree of importance. In the year 1896, during the Tungan revolt, a small garrison was stationed there, and others at Jurt-tschapghan and Tschertschen. The soil around the little place is fertile, though the means of irrigation are not particularly favourable. The quantity of rain that falls is so insignificant that it may be left entirely out of account. For their water-supply the people are dependent upon the stream that flows down the bed of the Tscharklik-su from the Astin-tagh, a rather precarious supply, because in dry summers it is far too little for the purposes of irrigation. Consequently the crops sometimes fail and turn out badly; but most years the supply of water is sufficient for the wants of the place.

Tscharklik lies scattered, though most of the houses are grouped round the bazaar, which consists of a single street. Here and there are small, but rather pleasant, orchards, and their fresh greenery is all the more inviting because the approach to the town is from every direction across a barren desert. I add two or three photographs, which will give an idea of the general character of Tscharklik. They were taken in the neighbourhood of the seraj, where I stayed five weeks before setting out on my long journey across Tibet, and where my caravan of horses, camels, mules, and asses was equipped.

Whilst this caravan travelled by the longer, but easier, route *via* Tatlik-bulak and Bagh-tokaj to the western end of the Lower Kum-köl, I myself chose the road

up the Tscharklik-su — a route in part rather difficult and seldom used. In fact that way of reaching the Tibetan highlands had never before been attempted by a European. Hence I was anxious at all costs to fill up a gap that would otherwise have existed in the map of the extreme north of the highland region. And I felt this task to be all the more incumbent upon me, because the picture of the upper Tscharklik-su which is given on the map of the Russian General Staff, and indeed on all other maps, of Northern Tibet, appeared to me *a priori* extremely improbable. And we shall find that the preconceptions which had been formed both of the orographical and of the hydrographical relations are indeed very inaccurate and misleading. The reader will readily be able to convince himself of this by comparing my general map of the region in question with any other map he thinks fit.



Fig. 307. MY CAMELS EATING MAIZE IN TSCHARKLIK BEFORE THE START FOR TIBET.

Immediately north of the bazaar of Tscharklik we crossed over a large arik, which issues from the right bank of the river. The slope of the country even here is so decided that the *baschi* or 'head' of the canal is only a couple of kilometers above the town. On the other side of it we at once plunged into barren ground, through which runs a broad, shallow bed, then however perfectly dry, and in fact giving rise but seldom to *sil-su*, or 'overflow water', that is to say a torrent from the mountains after violent rain. On the left bank of this river-bed stands a *kona-schahr*, although its ruins have for the most part crumbled away. All that now re-

mains are a few walls of sun-dried brick, together with a number of quite low ridges of stones arranged in squares and oblongs, showing how the former houses were grouped. This was clearly a former predecessor of Tscharklik, and to judge from the ruins that survive there must have been a pretty large number of houses. The cause of the existing town being removed eight kilometers lower down would seem to be changes in the course of the lower Tscharklik-su. A few kilometers farther south we find yet another kona-schahr, though it consists of nothing but heaps of yellow clay, amongst which the sun-dried bricks show distinctly here and there. This would appear to be a yet older forerunner of the old Tscharklik that I have just described. Its ruins lie on the left or western side of the artificially dug canal, the *baschi* or »head» of which is on the left bank of the Tscharklik-su. This canal does not however carry water to the little town itself, but to the steadings and hamlets that lie immediately west of it. Thus the lower Tscharklik-su flows between these two ariks; though at this season it contained only a very small quantity of water, for almost the whole of its volume was being led off in the canals.

Our route was east-south-east, following the Tscharklik-su, the bed of which we forded twice before definitively keeping to its left bank. The ground was somewhat broken, and consisted for the most part of coarse sand, perfectly barren. The ascent gradually grew steeper, and at the same time the river-bed became increasingly narrower as well as more deeply sunk. The atmosphere being exceptionally clear, the range of the Astin-tagh to the south was outlined with great sharpness and distinctness. It was pierced by two widely gaping glens. The one to the south-east really is a transverse glen, being that by which the Tscharklik-su makes its way out of the mountains. The other glen, to the south-west, is smaller and is known as the Kuruk-saj; this was the goal of our second day's march.



Fig. 308.

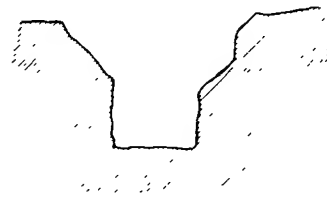


Fig. 309.

Camp I was made in a perfectly barren region, close to the summit of the scarped terrace on the left of the stream. Here we had a repetition of the characteristic relief forms that we find again amongst the eroded watercourses of Kirk-saj. The Tscharklik-su runs at the bottom of a very narrow gully, 30 to 40 m. deep, a veritable gorge or ravine, cut through the beds of detritus or gravel-and-shingle which have accumulated at the northern foot of the Astin-tagh. On both sides the gravel-and-shingle walls are vertical or excessively steep, and the only spot at which it is possible to get down into the bed of the stream is at Camp I, where there exists a steep fissure or side-ravine. By means of this it is possible, with due care, to lead

one's horses down to a small expansion at the bottom, known from the scanty vegetation which grows there as Jigdelik-tokaj. The profile of the glen is shown in the accompanying illustration (fig. 308); but the type shown in fig. 309 is the most common. The volume amounted here to about 7 cub.m. in the second and the water was very muddy. But after a violent rain the entire bottom of the glen is filled with a big tempestuous torrent, and this is possessed of very great erosive power. The accompanying illustration (fig. 310) gives an approximate vertical section through the lower course of the Tscharklik-su. No sooner does the river issue from the mountains than it plunges in amongst the gravel-and-shingle beds, and is deepest at  $a-b$ . At  $a_{II}-b_{II}$  the depth is only half as great; while at  $a_{III}-b_{III}$  the powers of erosion and deposition balance one another, in such wise that not only does the stream not carve out a permanent channel for itself, but it actually spreads out in deltaic fashion, and shifts its course from branch to branch.

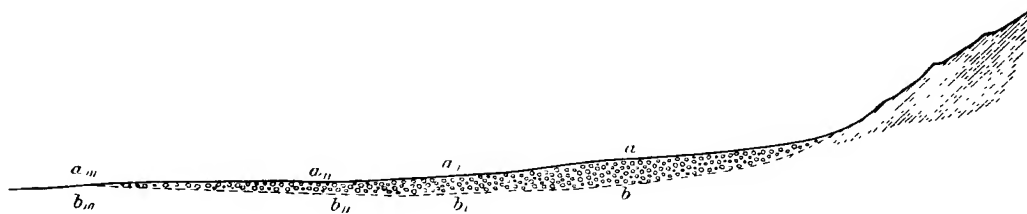


Fig. 310.

Although Jigdelik-tokaj lies merely 18.4 km. from Tscharklik, and although the difference of altitude between them amounts to only 240 m. (Tscharklik = 925 m.; Jigdelik-tokaj = 1165 m.), a real climatic difference was nevertheless observable, namely a change from the oppressive heat of the lowlands to the fresh, crisp air of the mountains. Down in Tscharklik we were annoyed by the gnats, but no sooner did we get beyond the vegetation of the little oasis than they disappeared completely. We were however still so far subject to the climatic relations of the lowlands in that the usual winds prevailed; and of this we had a clear proof in the evening, for at 6 p.m. there arose a terrific *kara-buran*, bringing with it impenetrable clouds of wind-driven dust. But no sooner does one leave the open, flat lowlands, and enter the mountains than one gets beyond the reach of these characteristic east-north-east storms.

May 18th. The air next morning after the tempest was a good deal cooler and a slight rain was falling, the usual concomitant, as I have already stated, of these violent tempests. Our course was now towards the south and south-south-west, the ascent becoming more and more perceptible and the ground being somewhat broken and hard, consisting as it did of sand and gravel. It bore a thin scattering of scrub — *tschakende* and *tschutschun*. At first we kept quite close to the scarped terrace on the left side of the Tscharklik-su, though afterwards we gradually departed from it and slowly approached the mountains at an acute angle, crossing on the way a great number of small dry torrents, that spring out of crevices, fissures, and narrow glens, short and steep, cleft in the front of the range that faces the desert. One of these is situated close to the spot where the Tscharklik-su itself emerges however fairly big. The portal at which the Tscharklik-su issues is dark and narrow, being wedged in between lofty mountains. From the plain



Pl. 67.



*Ljustr. A. B. Lagreus & Westphal.*

LOOKING WSW. FROM CAMP II.



below its glen is seen to wind, by short bends, from the south-east to the north-west according as the spurs and offshoots on either side project and overlap *en échelon*. The head of the glen is barred by an immense crest. The highest parts were in places streaked with thin strips of snow, probably only one night old. On the whole this part of the Astin-tagh extends towards the south-west and west-south-west, forming the south-eastern border of the mountain-ranges that encircle the Tarim basin. The watercourses which we crossed over were thus directed towards the north-west. The only one that succeeds in accomplishing its course is the Tscharklik-

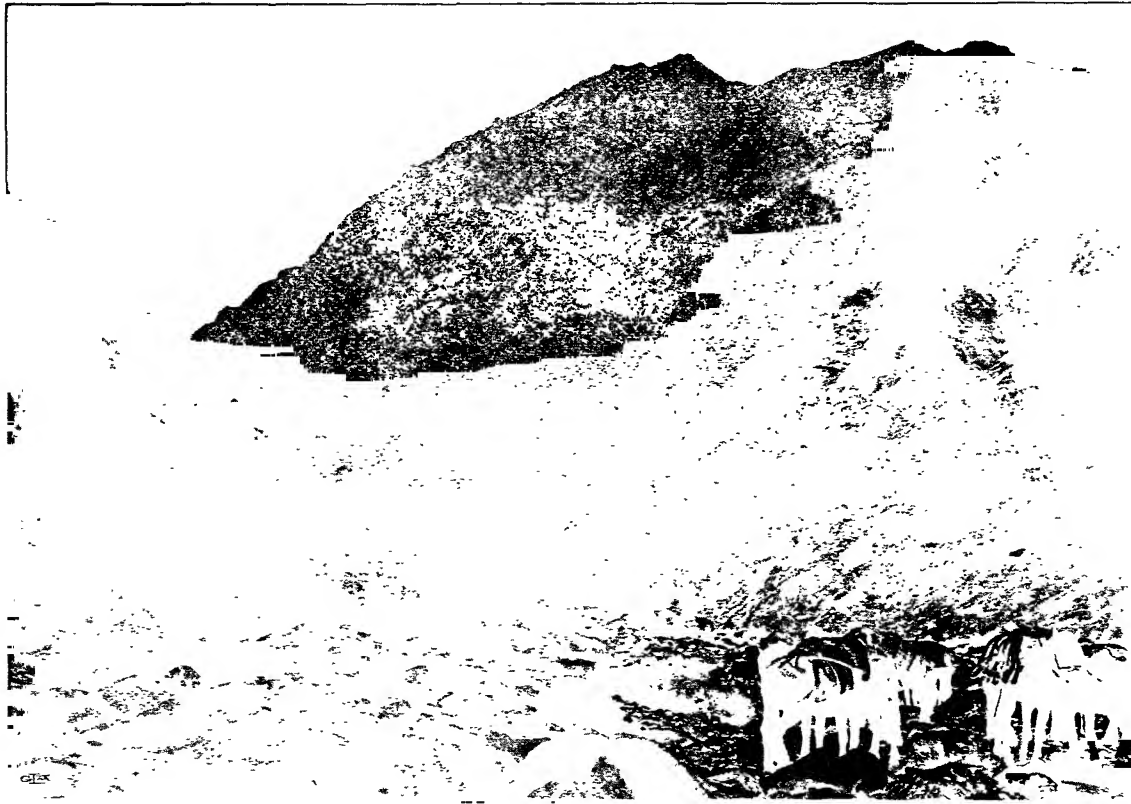


Fig. 311. LOOKING SSW FROM CAMP II.

su, the largest of them all. After emerging from the mountains, it flows at first towards the north-west and north-north-west, then towards the north, and finally it inclines towards the north-east. As for the part of the stream which actually forces its way through the lower Astin-tagh, I was unable to obtain any reliable information about it. The natives never travel that way; indeed they look upon it as impassable. It may however safely be assumed, that the narrow gorge is so far choked with gravel and stones that the only time at which it can at all be traversed is in winter, and then only on foot.

When we approached the lowest spur we happened to be on the edge of the scarped terrace on the right of the glen, which was there dry. Some of the natives call it for this reason Kuruk-saj, though others give it the name of Korumluk-saj.

The latter is the more correct form, and it agrees best moreover with the natural features; for, although the glen is, it is true, for the most part dry (*kuruk*), it is to an even more significant degree choked with gravel and stones (*korumluk*). At the point where it breaks out of the mountains the glen is framed in by clear-cut terraces of gravel-and-shingle. Between these we marched at first southwards, and then, upon reaching the hard rock, we turned to the south-east. Here the gravel-and-shingle terraces, which were at first arranged in steps one above the other, become lower, and after the glen narrows, they almost die away altogether, except for

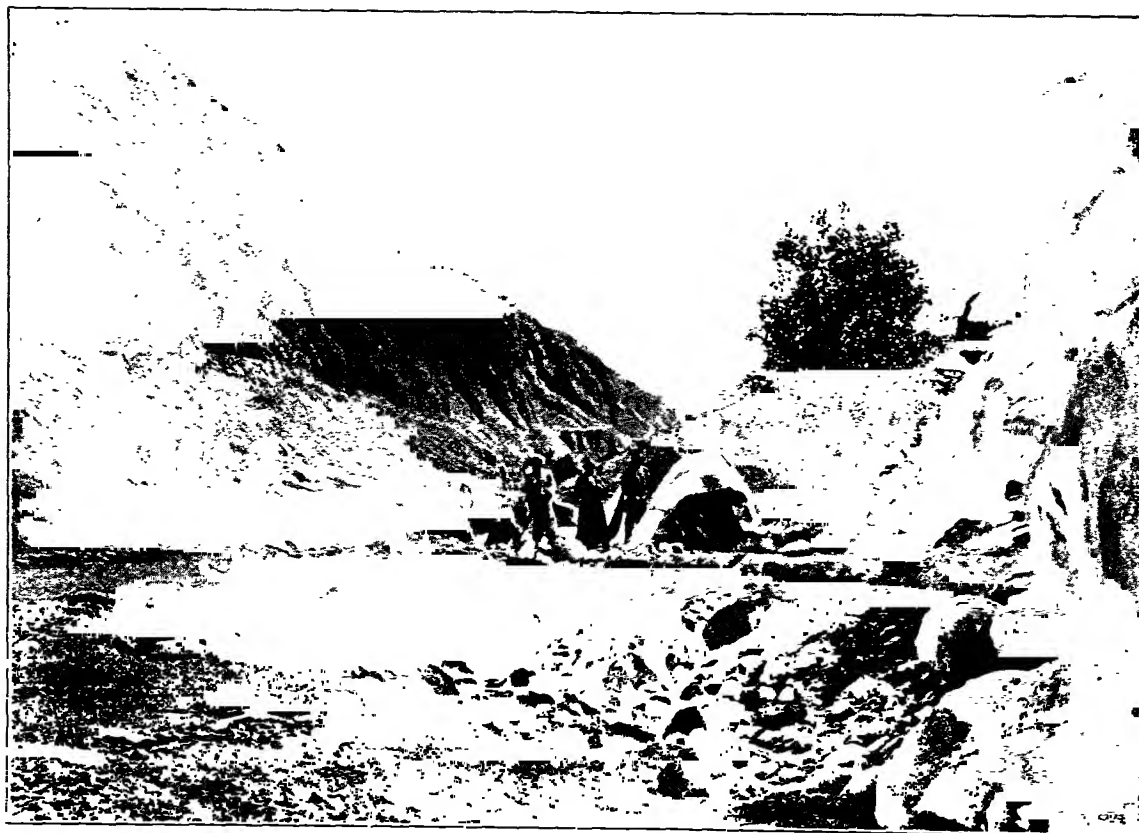


Fig. 312. CAMP II LOOKING N 53° E.

an occasional fragmentary survival. In their place bare, steep, wild cliffs rise on both sides. Generally speaking the bottom of the glen is destitute of vegetation, except for a few tamarisks and kamisch growing in sheltered crevices: the bottom is indeed too full of gravel and small stones to admit of plants striking root, in fact it was difficult enough to ride amongst them. The glen serpentine an endless number of times, rendering fresh compass-bearings a matter of constant necessity. At the entrance of the glen the rocks consisted of red granite and black striped granite, as well as of black schist. Higher up the last-named predominates. Quartzite also occurs.

Soon however we turned due east, and as we climbed up higher, the mountain-walls, which had at first reached a considerable altitude, grew lower, and behind the

nearest crests bigger and greater ones towered up still higher, proving that the former were only offshoots of the latter. The spring of Toghrak-bulak is now waterless, though a clump of fresh, deliciously green toghraks were growing beside it. The bed of the watercourse at the bottom of the glen was still moist after the last rain that fell, and in some of the hollows there were still pools of water. We were now marching towards the east-north-east and north-east, so that we were virtually travelling parallel with the northern foot of the mountains. The acclivity up to the little pass of Toghrak-bulakning-davan is pretty steep, though not difficult. The altitude at the entrance to the Korumluk-saj is 1503 m.; at the little secondary pass, it was 1956 m.; and at Camp II, at Tscharklik-su, on the other side of the pass, 1644 m. Thus the pass lies in the spur which overhangs the left side of the Tscharklik-su, and the Korumluk-saj is a rather unimportant glen on the west side of the same spur. The glen by which you descend from the pass likewise runs towards the east-north-east and forms a side-glen to the principal glen of the Tscharklik-su. At Asghan-bulak, or the Spring of the Wild Brier, we found a little pool containing water and encircled by tamarisks, wild briers, and other bushes. Below it the glen itself is so narrow and so choked with stones that the track has had to be carried along the slopes on its right side, and from them one descends by a steep brae to the bottom of the side-glen. At the point where the side-glen joins the principal glen some poplars were growing, and the grass was relatively good. The country there is picturesque; the little expansion lies ensconced amid majestic mountain-masses. The Tscharklik-su, which appeared to have been swollen by the last rain, but was then subsiding, nevertheless filled the glen with its rush and its roar. Here too the river makes a sharp bend, in that it turns from the north-east to the north-west and then effects its passage through the lower Astin-tagh. In the short distance from this point to the mouth of this glen, that is to its actual exit from the mountains, the fall is 150 m. At 7 a.m. on the 19th May the stream had the following dimensions: breadth, 10.9 m.; mean depth, 0.51 m.; maximum depth, 0.65 m.; mean velocity, 1.274 m. in the second; and volume, 7.08 cub.m. in the second. In a little mountain torrent such as this the volume naturally varies a good deal, not only from day to day in dependence upon the rainfall, but also during the course of a single day. Even in the photographs of Camp II, herewith appended, the higher water-marks can be distinguished. During the 19th May the rain came down two or three times pretty smartly, and the stream rose somewhat in consequence.

On the 20th May we only travelled 4 km. to the east-north-east up the glen of the Tscharklik-su; but short though the stage was, it proved more difficult than most. For one thing, we had to cross over the stream no less than seventeen times, and this was rather dangerous for our baggage; for owing to the bottom being so full of stones, our horses and mules ran great risk of falling. Add to this the fact that the stream had in the morning perceptibly swollen in consequence of the latest rainfall. The narrow watercourse is not only deeply cut in the greenstone, but also winds backwards and forwards a good deal. The stream is for the most part embraced between semi-peninsular terraces of gravel-and-shingle, though the projecting buttresses are generally covered with earth and overgrown with grass, bushes, and an occasional toghrak. The bottom of the glen is one confused mass

of rounded, water-worn fragments of granite. On both sides it is overhung by stupendous cliffs of the most capricious and eccentric shapes. In a word the scenery is that which is typically characteristic of a transverse glen cleft through granite, that is to say at once rugged, fantastic, and grand. Every now and again we passed a little expansion where vegetation grows, ideal spots for a camp. The glen was wreathed in a slight mist, enhancing in some respects its mystical and majestic attributes. All the way up the prevailing rock was coarse-grained grey granite, occurring in several varieties, and shot through with veins of pegmatite of greater or less thickness. Black schists also occurred. The mountains that shut in the glen frequently shoot vertically down into it, or where they are directly exposed to the erosive action of the Tscharklik-su actually overhang it. We pitched Camp III in an expansion known as Mätschit-saj, or the Glen of the Mosque, a peculiar but appropriately selected name. The entire scene did in fact suggest the interior of a temple or a Roman Catholic cathedral, and the resemblance was rather heightened by the mist, which put me in mind of the blue-grey clouds of vapour that gather under the roof of a temple.



Fig. 313. LOOKING UP TO THE JAMAN-DAVAN.

May 21st. Above Mätschit-saj the main glen of the Tscharklik-su is impassable, being completely filled with stones. Accordingly we turned out of it — here too it appeared to come from the south-east — and struck up a side-glen which just there joins it. This was dry, and also thickly littered with stones and gravel, as well as fenced in by steep walls of rock. It winds to only a very slight extent, but is beset on both sides by several fissures and side-glens. Even in its lower part the ascent was distinctly noticeable, and was made more difficult by the gravel and stones with which it was littered. Higher up the blocks of stone are of gigantic size and water-worn, though with a rough and weathered surface. Occasionally we



*Ljost, A. B. Lagrelius & Westphal*

LOOKING WNW. FROM CAMP II; THE HIGH TERRACE ON THE RIGHT SIDE OF THE TSCHARKLIK-SU.





Pl. 69.



TO THE N. 75 E. FROM CAMP III.

*Lynx, f. B. Lagrelius & Westphal.*



came across small patches of tamarisks and grass. Here there is a little spring, with bright fresh water, known as Julghun-bulak; but it was only able to give rise to a rivulet of about 40 m. in length, after which it disappeared among the gravel. Above that point the glen grows extremely narrow and the ascent steeper and steeper. Even the track itself is only visible occasionally; it has been partly washed away by the chance violent rains, partly it is only seldom used and then almost exclusively by the inhabitants of Tscharklik when driving their horses up to the higher grazing-grounds in summer, where they leave them to look after them-

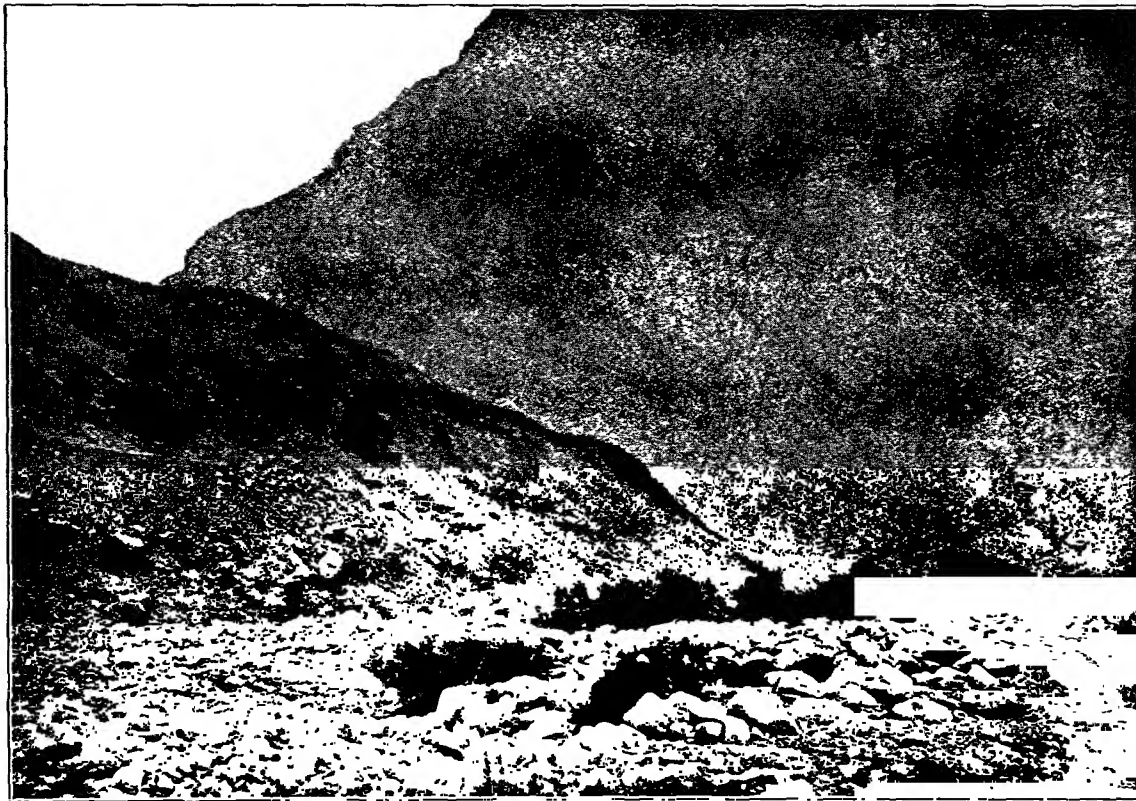


Fig. 314. LOOKING N 20° E FROM CAMP III.

selves as long as the grass is good. At length the glen contracts to its head-sources, three small glens containing springs. The biggest of these is the one farthest north; this may be regarded as the real beginning of the Mätschit-saj. The track however follows the middle stream of the three, namely a steep torrent, which comes down from the pass of Jaman-davan. This name, which means the Bad (i. e. Difficult) Pass, is significant, for the pass is indeed one of the most difficult I have had experience of in this part of Tibet. The last piece of the ascent is difficult even for horses, and the loads kept constantly slipping off our pack-animals. The summit of the pass itself is so narrow and sharp that only one horse at a time can find room on the top of it. By this pass of Jaman-davan we thus crossed over the spur of the Astin-tagh which borders the Tscharklik-su on the right or west. The

pass itself makes a rather deep gap in the spur, for both north and south of it the mountains swell up into great cliff-like masses. Here we found arkharis and partridges. In the course of the relatively short stage from Camp III we climbed no less than 1450 m., for the absolute altitude of the Jaman-davan is 3136 m.

So long as we were in the Mätschit-saj we marched uniformly east-north-east, and the glen leading down from the pass still continues to follow the same direction. On that the eastern side the descent is far less accentuated, and also easier, owing to the fact that the surface is earthy and grass-grown, both gravel and stones being absent. Around the pass there were patches of snow on the slopes facing north; and on the east side they were large enough to give rise to a little brook, which

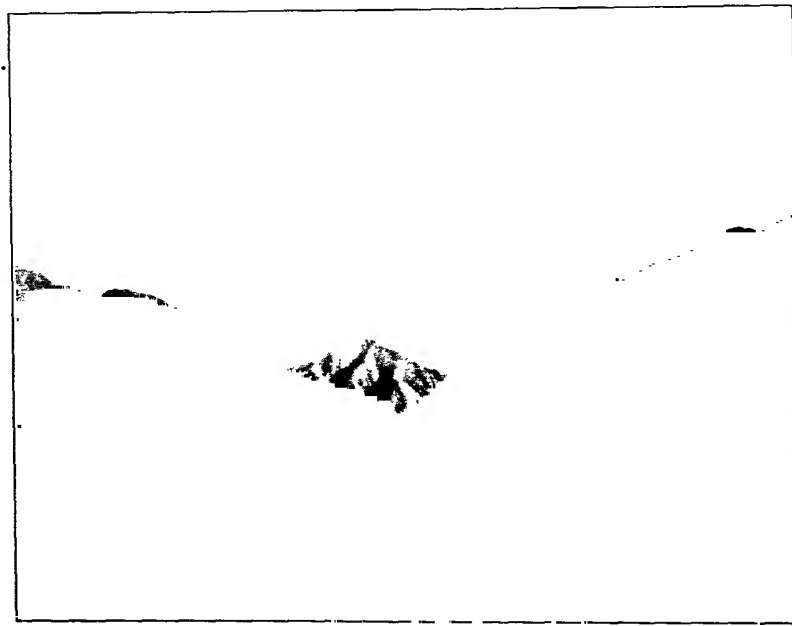


Fig. 315. MOUNTAIN SCENERY FROM LOWER ASTIN-TAGH.

we followed the whole of the way down, the brook being augmented at intervals as it descended. Lower down this glen also contracts, and becomes plentifully strewn with gravel, and finally it is just as awkward as the western acclivity. Often the track avoids the bottom of the glen and climbs up on the slopes at the sides, where the wild briers grow amongst the gravel. Then down we would go steeply into the bottom, and soon up again on the opposite side. In some places however we were able to ride along the bottom of the watercourse. Here again, thanks to the energetic and bold relief, the scenery is of the grandest, new views bursting upon us without cessation. We soon came to the spring of Tschivilik-bulak, surrounded by bushes and *tschilve*. Below it we found toghraks growing in a triangular expansion where two glens meet. There too balghun bushes, grass, and other vegetation thrive, the little oasis being both cool and pleasant. Its full name is Tölkölikningki-ajaghi-koschlasch, i. e. the Meeting-place of the Lower Part of the Fox Spring; though it is generally called simply Koschlasch. Minor windings being disregarded,

Pl. 70.



*Lipso, A. B. Lagrelius & Westphal*

CAMP IV, LOOKING DOWNWARDS.



the two glens which unite here form practically one straight line running from west to east or rather a little towards the east-north-east. On the south they are bordered by an imposing and connected range, while on the north of them is the Lower Astin-tagh, which, as we have seen, is pierced by the Tscharklik-su. Below Koschlasch this latter range is also pierced by the stream that is formed by the two conjoint glens, namely that which comes down from the Jaman-davan and that from Tölkölik-bulak. Just below Koschlasch its direction is N.  $10^{\circ}$  W., though it winds about a good deal; but on the whole it preserves a direction parallel to the transverse glen of the Tscharklik-su, that is to the north-west. I was told that it debouches upon the lowlands not far to the east of the glen-outlet of the Tscharklik-

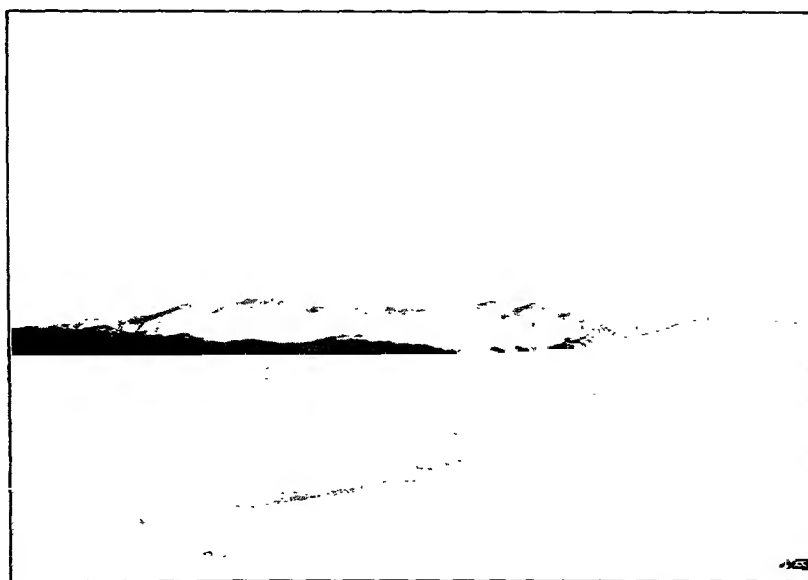


Fig. 316. FROM THE UPPER ASTIN-TAGH.

su; and from Jigdelik-tokaj a rocky gateway is indeed visible in that position. But in point of wildness and grandeur the glen of Koschlasch cannot compare with that of the Tscharklik-su, but then its source region in the mountains covers a less extensive area. Whereas the Tscharklik-su cuts through both parallel ranges of the Astin-tagh, it is only the lower range that is cleft by the Koschlasch; and the volume of the latter is so insignificant that it is unable to advance especially far from the foot of the mountains, still less to promote the fertility of any cultivated ground. In this respect of the rivers that flow down northwards out of the southern border-ranges of East Turkestan the Tscharklik-su is the last towards the east that can be utilized for irrigation, and I have already pointed out that the streams which from the south flow into the main artery of the Tarim system increase in size from east to west until we come to the Jarkent-darja.

The absolute altitude at Koschlasch amounts to 2394 m., and consequently it is very appreciably higher than the corresponding point in the breach of the Tscharklik-su; for there the altitude is 1686 m. The erosive energy of the larger river has

thus cut out a much deeper channel. All the way between Camps III and IV we marched amongst granite of divers kinds. The pass of Jaman-davan is embedded in grey granite.

On the 22nd May we ascended the glen of Tölkölik for no less than 24 km., and the resultant of my compass-bearings was N.  $74^{\circ}$  E., whereas the glen of Jaman-davan runs N.  $75^{\circ}$  E. Hence we may reasonably take it, that these two glens correspond to a latitudinal valley parallel with the long axis of the mountain-ranges. The glen of Tölkölik ascends in a tolerably uniform way, though very gently; is narrow, being squeezed in between its perpendicular craggy walls; is full of gravel and smaller stones; and is traversed by a rippling brook. It is moreover joined by several small transverse glens, though one or two of them are larger and afford more extensive views; but as a rule the summit of the main range on each side is masked by the nearest spurs and buttresses. One of these side-glens, which comes from the south, carried even then a little water. On the whole the glen runs fairly straight in the direction I have indicated, although at the same time it shows a number of small projecting angles where the rocks jut out. The usual vegetation thrives on several little level expansions. The track was mostly indistinct.

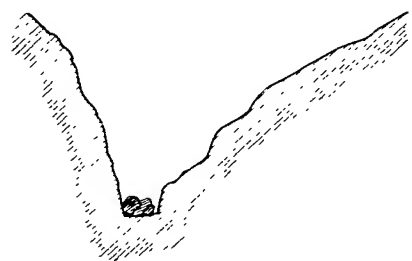


Fig. 317.

At one especially narrow place the brook tumbles over a rocky threshold or sill 3 to 4 m. high, and below that the watercourse is blocked almost all the way across by a couple of huge pieces of granite (fig. 317). Here it was impossible for horses with loads to get past; accordingly we had to unload them and carry their burdens ourselves up past the cascade. Above this place the glen widens out again, and the going became easier, the surface consisting for the most part of soft earth free from gravel. At the same

time the vegetation grew more abundant. The relative altitudes of the mountains decreased, though they were still imposing. Some of the side-glens are so large, that if one were without a guide, one would be in doubt as to which was the main glen. At Camp V, Tölkölik, two glens thus unite, the larger of the two coming from the N.  $10^{\circ}$  E. At its head we saw the crest of a dark and imposing range, with a large quantity of snow upon it, evidently fresh-fallen; during the last few days the sky had been generally clouded. That crest was however the summit of the Lower Astin-tagh, which farther west is pierced by the two transverse glens that I have mentioned. Thus at Tölkölik we were on the south side of this great mountain wall; so that along this route you have no need to cross over it by any pass, but instead you use the little secondary pass of Korumluk-saj and the transverse glen between Camps II and III.

The brook in the upper part of the glen of Tölkölik was destitute of water, being only a little moist; but at 5 p.m. it was again full, for a brook bringing about  $\frac{1}{3}$  cub.m. of water in the second issued out of the glen that comes down from the N.  $10^{\circ}$  E., being derived from the melting of the snows during the day. The water was thick and muddy, and after gradually filling all the hollows in the watercourse it afterwards continued on down the glen.





*Lynce A. B. Lagrelius & Westphal.*

CAMP IV, LOOKING UP THE VALLEY.



During this stage I took the following specimens of rock: a hard black crystalline schist, dipping  $81^{\circ}$  towards the S.  $15^{\circ}$  E., and forming dark bands and cornices, which stood out in an especially conspicuous way against the disintegrated gravel, the usual material of the slopes; a dark green schist, dipping  $62^{\circ}$  towards the S.  $45^{\circ}$  W.; and finally the same predominant dark schists with a dip of  $57^{\circ}$  towards the N.  $22^{\circ}$  W. The schists are however interrupted at intervals by swellings of grey granite and in one or two places by red coarse-grained granite. The gravel and rocky fragments that litter the bottom of the glen consisted as hitherto almost exclusively of grey granite.

May 23rd. During the night the thermometer dropped as low as  $-6^{\circ}$ , decidedly cold considering the time of year; the altitude was however as much as 2922 m. At that altitude the fresh grass had not yet made its appearance; what did exist was a survival from the preceding autumn.

Leaving Tölkölik we travelled south-east up to a little pass near by, which is however of considerable orographical importance as a water-divide between Tölkölik and the next glen. Its altitude is only a score or so of meters above Camp V, and it is situated amongst exclusively earthy formations. The glen that descends over on the other side goes down so gently as to be imperceptible to the eye. It was dry and stony, and makes some rather sharp turns. Here and there were patches of scanty grass and scrub. We again saw the summit of the Lower Astin-tagh at the head of a northern side-glen. The spurs which embrace this new glen are relatively low, and gradually decrease still farther in height, until at last they consist simply of disintegrated material and yellow earth; the only place where we detected hard rock was high up close under the summit of the main crest and at the foot of the mountains, where the torrent has eaten its way in at the windings of the glen. While the glen inclines to the east-south-east, south-south-east, and finally to the south-south-west, making a wide arc, the mountains dwindle into the rather low hills, which recede more and more from one another, until at last the glen terminates in an extensive open arena, paved with soft soil and grass of the previous year, on which kulan droppings were abundant. Indeed we saw some kulans there. Here the track was distinct. On our right we had, close at hand, a pretty low range of mountains, consisting for the most part of earthy material. The opposite range, on the left, that is the east, was a good distance away; this was bigger, of a black colour, and touched in places with snow. Here and there were other snow-capped mountain-masses, the arrangement of which it was difficult to make out at that distance. The open steppe stretching between those ranges is called Lajdang, or the Clayey, because sediment and clay are washed down, especially off the range on the right, and so form level expanses. There was no running water visible anywhere in this locality. The arena of Lajdang does not however form a closed basin; it is only a valley expansion, upon which several other glens debouch farther east. It contracts towards the south and gradually merges into a rather narrow glen, with a gentle slope. On our right we still had the same curving range as hitherto, and on the left rather low hills, while beyond them appeared a main crest at about 8 km. distance. In point of dimensions the descending glen is rather insignificant; hard rock shows here and there in its watercourse. Instead of following this glen down

to its junction with the Tscharklik-su, we left it on our right and crossed over the flat, soft spur which separates it from the nearest side-glen on the south. This last is more energetically excavated and possesses a stony bed, as well as rather decidedly accentuated erosion terraces. This glen also runs towards the south-west, and at Haschäklik joins the Tscharklik-su, forming an expansion with good grazing

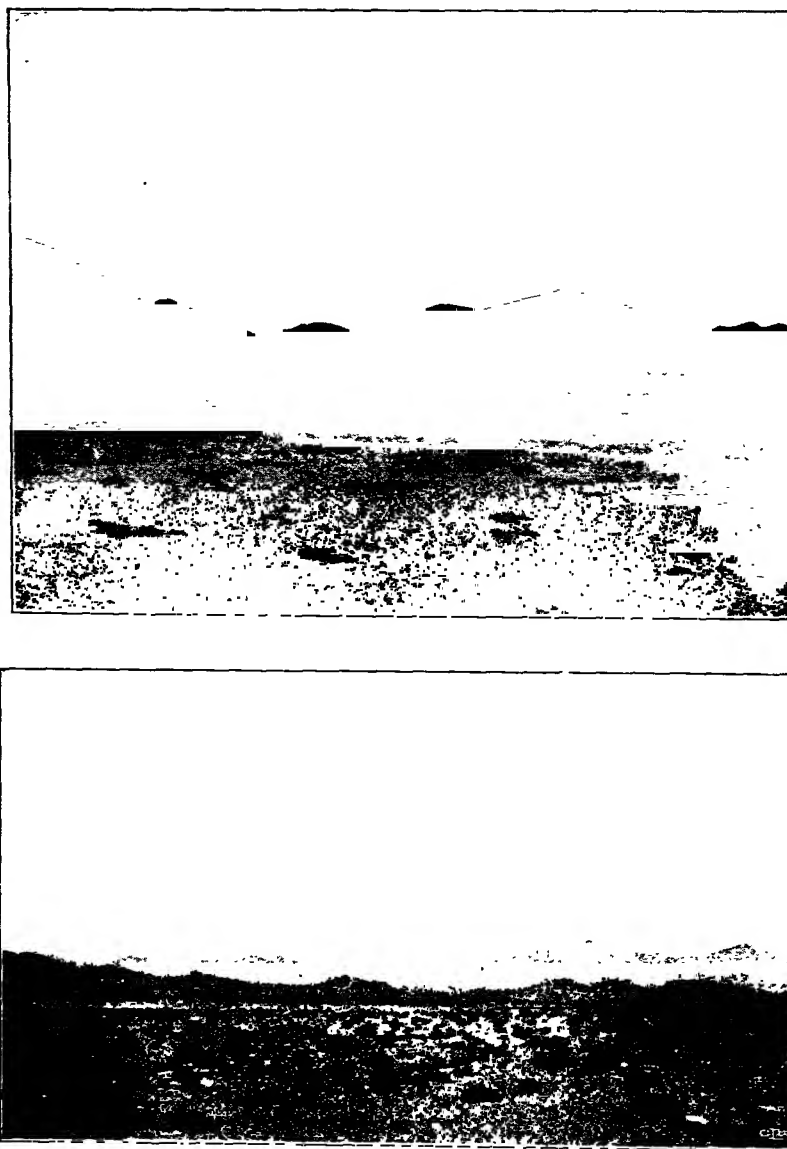


Fig. 318. OPEN VALLEYS IN THE UPPER ASTIN-TAGH.

and fuel. Several similar side-glens debouch here upon the principal glen, the upper breach of which we had avoided by making a rather wide detour. If the glen of Tscharklik-su were practicable all the way, the distance between Mätschit and Haschäklik would be essentially shortened.

At the little pass over the water-divide between the transverse glens of Koschlasch and Tscharklik-su, we found the same black schist as before, dipping  $59^{\circ}$  to-



*Lysko, A. B. Lagrelius & Westphal*

HASCHAKLIK, VIEW LOOKING UPWARDS.



wards the N.  $35^{\circ}$  W. After that came several varieties of granite, gneiss, and crystalline schist.

The sky was veiled with heavy, dark clouds and every now and again it snowed, the adjacent mountains being in part sprinkled with snow. The stream was a good deal smaller here than at Camps II and III, having a volume of only 2.6 cub.m. in the second, while its breadth was but 6 m., its maximum depth 0.70 m., and its velocity a trifle over 1 m. in the second. The water was of a very peculiar and unusual colour, being very nearly milky white; the cause of this was no doubt some soft light-coloured earthy matter higher up. At our camp the Tscharklik-su came down from the S.  $14^{\circ}$  E., although higher up its course is probably more south-east to north-west. From the same point the glen slopes down towards the N.  $55^{\circ}$  W.

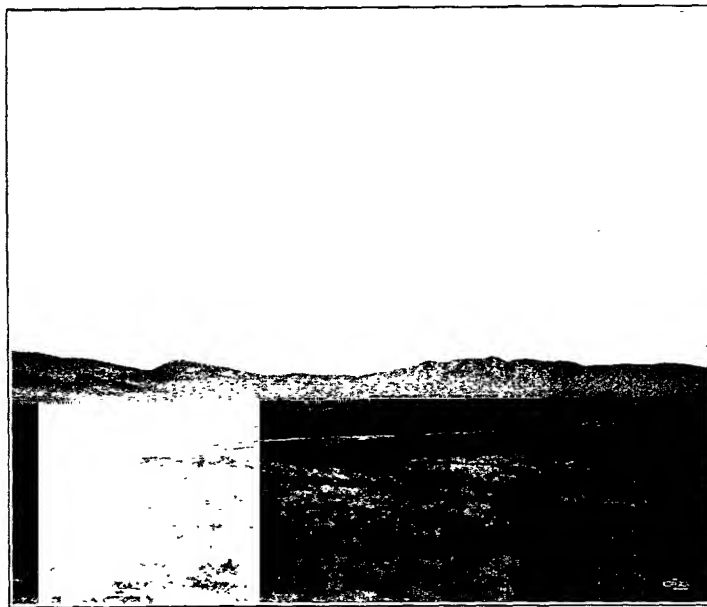


Fig. 319. OPEN VALLEYS IN THE UPPER ASTIN-TAGH.

May 25th. The weather amongst these mountains was more like winter than summer, but then we were steadily climbing up to higher altitudes. At Haschäklik we were 2894 m. above the sea, and during the course of the day, in which we travelled 25 km. to the south, we ascended a good deal higher still. We now definitively left to the south-east the Tscharklik-su and the mountainous region in which that stream has its sources and feeders, forded the stream at Haschäklik, and proceeded south-west to a quite low pass or saddle of soft material. Over on its west side a small watercourse leads down to the large, but waterless, glen that makes one of the left-hand side-glens of the Tscharklik-su; this we followed up as far as the pass at which it originates. It is rather winding and is fenced in with terraces of gravel-and-shingle and earth, on which grows some vegetation, grass and teresken. These terraces are backed by low, rounded hills, behind which rise dark ranges of more formidable dimensions. In its upper part this glen is joined from the right by the glen

of Jol-saj, which really is the main glen, and is said to come from the mountainous regions in which the Tscharklik-su also has its sources. We saw no signs of wild animals except the track of a bear. Strange to say, neither the glen nor its pass possesses a name. The acclivity leading up to the latter is rather steep, though not particularly difficult, for the surface consists of soft earth with a sprinkling of grass. The first pass is of a secondary character; the second, the pass proper, has an absolute altitude of 3493 m.

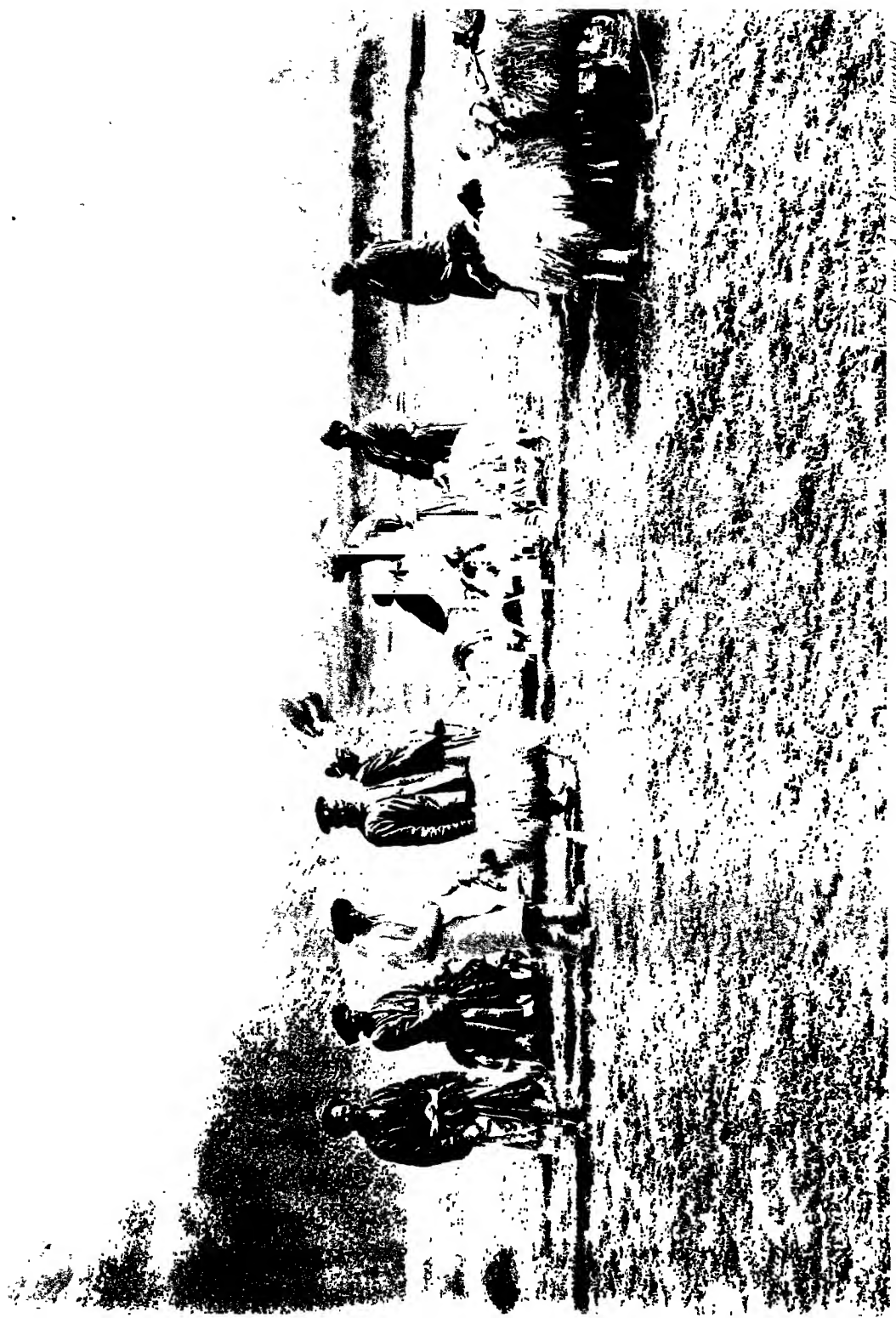


Fig. 320. CAMP VII. UNKURLUK.

A small and quite short glen leads down to a broad open *thalweg*, which eventually terminates in the similarly broad, open glen of Unkurluk, and this slopes gently down towards the north-west until it joins the Tscharklik-su a little below Haschälik. At the bottom of the *thalweg* is a shallow, gravelly bed, without any water. When we were on the pass it began to snow, at first in fine round pellets, but soon in thick, heavy flakes, making white the whole country south of the pass. During the evening vast quantities of snow fell; but on the following day most of the snow disappeared off the level ground, and only remained on the slopes of the mountains.

We marched up the gently ascending glen, which finally widens out into the open grazing-grounds, spacious and excellent, of Unkurluk. Camp VII was pitched in the mouth of a small side-glen on its right side. The name Unkurluk, meaning Earth-caves, betrays that human beings dwell there; and after a little search we did





CAMP VII, UNKURLUK.

*Lipate, A. B. Lagrelius & Westphal*



indeed find some shepherds, who were in charge of 600 sheep and several horses belonging to a baj in Tschertschen. They numbered in all 18 persons and are said to spend the entire year up amongst these mountains, only changing their pasture-grounds from time to time. Most of them dwell in wretched earth-caves, partly covered over with *kigis*, or »felt carpets», though they likewise possessed a couple of rough and ready tents. They obtain their supply of water at this season and in winter from springs. The reason the Unkurluk-saj did not then carry a drop of water was, that the cold was considered to be still too great up in the region of its sources. Summer would not make its appearance there for a month yet, that is not until the end of June; it is then that the young grass shoots up and the water begins to come down the glen. The only warm months are July and August; autumn begins early, and the winter is bitterly cold. The wild animals embrace arkharis and *kökmel* goats (*Pseudois Vahoor*), and sometimes wild yaks. The last-named had been especially numerous during the preceding autumn. Other members of the local fauna were kulans (sometimes), wolves, and bears. Mountain-partridges were numerous; we heard them calling to one another all over the mountains.

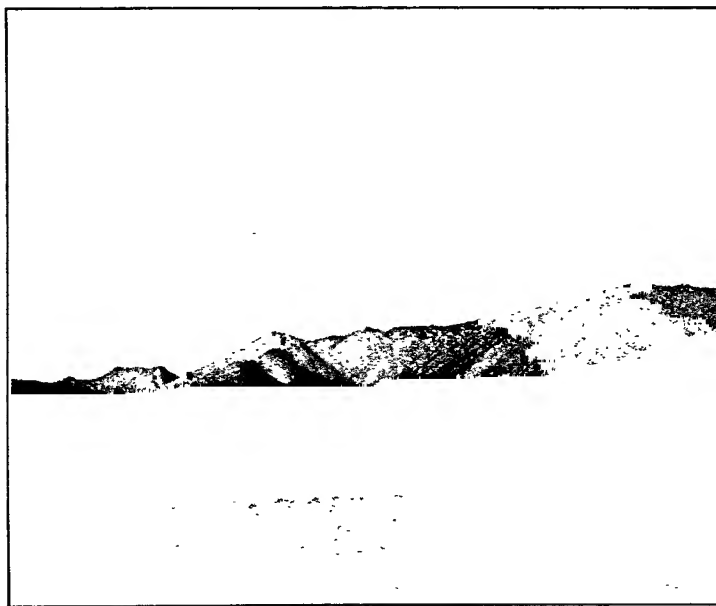


Fig. 321. MOUNTAINS NEAR UNKURLUK.

I was told, that there are two tracks in the upper part of the glen of Unkurluk, the more easterly one being the nearer and the more convenient, though at that season it was considered unsuitable because of the last snow-fall; we were accordingly advised to choose the other and more westerly road.

The greater part of the day's march was amongst soft earthy ground, though gravel of red and grey granite was common in the bottoms of the glens. These latter assumed the form of hard rock in only a few places. Where we debouched into the Unkurluk-saj we observed light green schists, and at Camp VII mica-

schists dipping  $76^{\circ}$  towards the N.  $20^{\circ}$  W. Here the altitude was 3629 m. above sea-level.

May 27th. A great number of spring-fed rivulets converge from every direction, and especially from the great snow-clad mountain-ranges on the south, into the open plain of Unkurluk, which slopes towards the north-west. Thus the region around Unkurluk forms a trough-shaped gathering-basin, capable of holding vast quantities of water when it rains in the summer. The usual route to Kar-jaghdi proceeds due south from Unkurluk, crossing over three passes. This we passed, as I have said, on the left hand, and travelling towards the south-west crossed over both the eroded water-courses of Unkurluk. These unite somewhat farther down; the one on the left contained a little water from the melting of the snow of the day before. A tiny side-glen led us up to the first pass, situated in the spur which separates Unkurluk from the glen of Kisil-partscha or Partschalik, lying to the west of it. The spur in question consists of soft grass-grown hills, and is so low, that the pass is only 45 m. higher than the plain of Unkurluk. It is however safe to say that lower down it grows bigger, seeing that it effectually prevents the two glens from uniting; for the Kisil-partscha, which also slopes towards the north-west, debouches directly into the Tscharklik-su. The main glen of Kisil-partscha is, like that of Unkurluk, broad, and possesses a wide source-region, which is none the less smaller than that of its neighbour. On the south it is backed by the same snow-clad main range. If one may judge from the marks of erosion, this glen too would appear to be traversed by pretty considerable bodies of water.

The track, still maintaining a south-west direction, ascends a side-glen and so reaches another pass in soft ground, being barely 20 m. higher than the former pass, and situated in a chain of heights that separate Kisil-partscha from the next glen on the west. The latter is however relatively insignificant, and is embraced amongst soft hills, besides which it soon runs into the Kisil-partscha. After following it for a space towards the north-west, we left it on our right, and turned south-west up a couple of similar glens. Of these the larger one, on the west, is called Jaka-saj, a name said to have been conferred upon it because it is situated »by the side of» the larger Kisil-partscha. The Jaka-saj brought us up to the third pass of that day, and the highest, namely 3797 m. On the other side of this pass even the level spaces were covered with snow, and consequently slippery and insecure under foot, the surface consisting entirely of earth and clay. Here and there we saw tiny rivulets in the bottoms of the watercourses; but they were too feeble to gather into brooks. We were now separated from the fourth secondary pass by a fresh gathering-basin belonging to a side-glen of the Ghulmet-saj; this pass lies a dozen meters lower than the last. On its southern side we travelled by gently rising, broken ground, that drains into the rather great and broad Ghulmet-saj, crossing on the way over a host of spring-fed rivulets, some of which contained a little water. This region is separated from another gathering-basin on the south by a low saddle. The glens and watercourses of this second gathering-basin converge upon an independent main glen, which instead of uniting with any of those that I have just mentioned, cuts its way through the Astin-tagh independently, and thus forms a separate transverse glen, which is said to debouch upon the lowlands at Tatlik-bulak, so that it terminates a day's journey south-west of the outlet of the Tscharklik-su. There exists no direct

road through this glen; probably it is, like the Tscharklik-su, too greatly obstructed with gravel and stones; nevertheless there is a mountain-path by the side of it.

Our track led up through the most southerly of the side-glens of the glen of Tatlik-bulak. This side-glen, which is rather small and pretty deeply cut, is rightly named Kisil-su, for the little brook that was then coursing down it was of a brick-red colour. One more pass or saddle, extremely flat, brought us into the next main glen, that of Kar-jaghdi, which where we struck it was coming from the S.  $40^{\circ}$  E. and then proceeded towards the N.  $60^{\circ}$  W. Here we made Camp VIII beside a little spring, which formed a large ice-sheet in the bottom of the glen. There was fairly good grazing on the gentle hills round about. The altitude was 3860 m.



Fig. 322. LOOKING S  $38^{\circ}$  W FROM KAR-JAGHDI.

All day long we had had an imposing range on our left hand and that not very far away. The passes which we had successively crossed over were situated in the spurs and ramifying arms of that range, and thus were entirely secondary in character. Further, we had ascertained that the Unkurluk-saj joins the Tscharklik-su below Haschäklik, as also does the Kisil-partscha a little way below the end of the Unkurluk. The Jaka-saj joins the Ghulmet (= Kul Muhamed, being named after a man from Tschertschen, who used to come there hunting), and this latter debouches upon the Tscharklik-su half-a-day's journey above Mätschit. The Ghulmet-saj is the farthest south of the glens that belong to the catchment-area of the Tscharklik-su; south of it begins the catchment-area of the Tatlik-bulak. I was told,

that in five days, supposing one marched 30 km. every day, one might reach Dimen-  
alik, a point on the mountain-road between Tschertschen and Temirlik. Three days  
are required to reach a pretty easy pass, on the other, that is the western, side of  
which begin the sources of the brook which runs down to Vasch-schahri. On the  
south of this route rises a mountain-range called Karava-tschalik, or the Black Craggy  
Mountains. Another pass along this same route is said to divide the waters of the  
Vasch-schahri from those of the Tschertschen-darja.

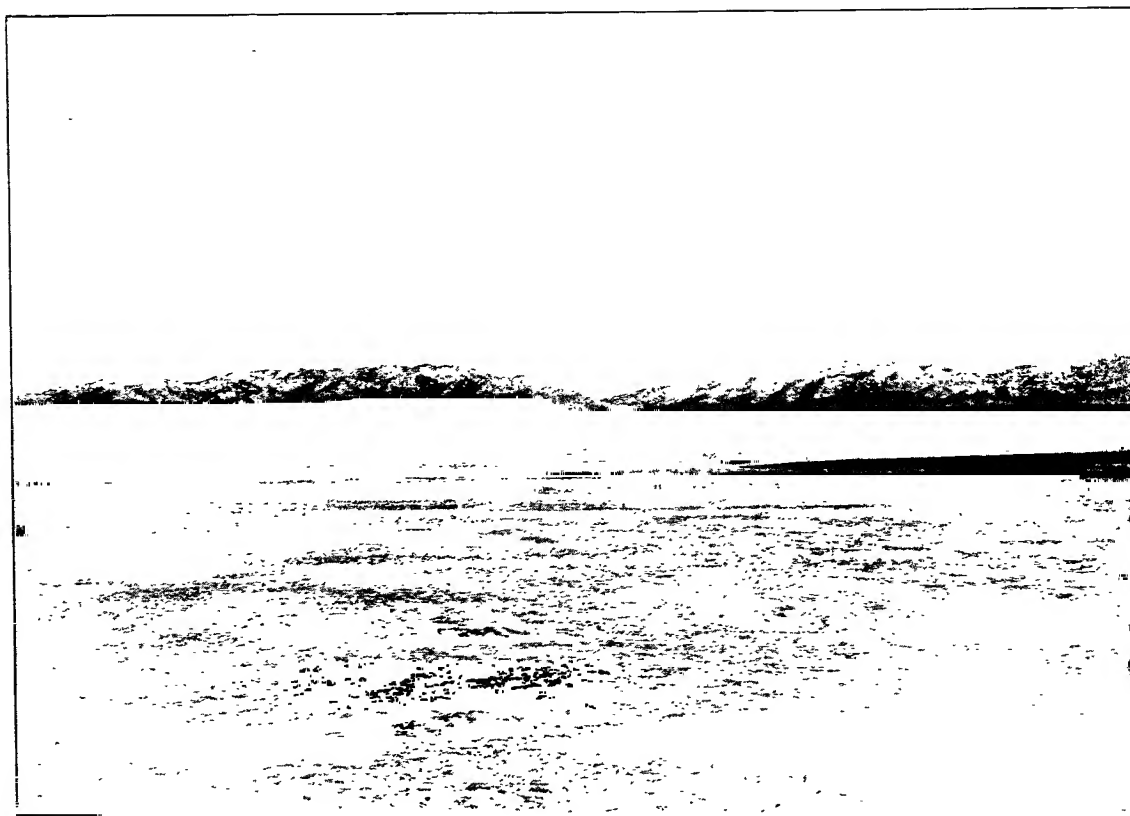


Fig. 323. LOOKING S 2° E FROM CAMP IX.

The varieties of rock that I observed during the course of this day were an  
extremely fine-grained, dark green, hard rock, dipping 47° towards the N. 50° W.;  
at Kisil-saj a hard, dark mica-schist, dipping 60° towards the S. 60° E. Otherwise  
we rode all day across soft, earthy ground, hard rock being remarkably rare, and  
only once or twice within reach.

May 28th. This day we travelled principally east-south-east, ascending first  
the glen of Kar-jaghdi, which from Camp VIII continues on towards the N. 60° W.,  
until it at length joins the Tatlik-bulak. Its bed is level and has a gentle ascent,  
and is filled with fine gravel, through which were trickling a number of tiny rills caused  
by the melting of the last fallen snow, and coloured brick-red by the severely  
weathered and fast crumbling red sandstone and conglomerate, of which the erosion  
terraces of the glen are composed. This sandstone seemed to be bedded at an



Lights A. B. Lagrelius & W. J. Hall.

LOOKING S. 50° E. FROM CAMP VIII, KAR-JAGHDI.





angle of  $40^{\circ}$  N., and the conglomerate at  $73^{\circ}$  to the S.  $30^{\circ}$  E. Every now and again the glen contracts to a rather narrow gorge, though its containing terraces still continue low. It is joined on both sides by a host of small side-glens, some of them issuing through deep-cut, narrow portals. On the south our glen is bordered by rather low mountains, to which we gradually approached nearer, while on the north rises a decidedly imposing snow-white mass, the snow on which is not however perpetual, but disappears in the summer. The relative altitude of the range on the south is not more than 150 m., while the mass on the north rises to at least

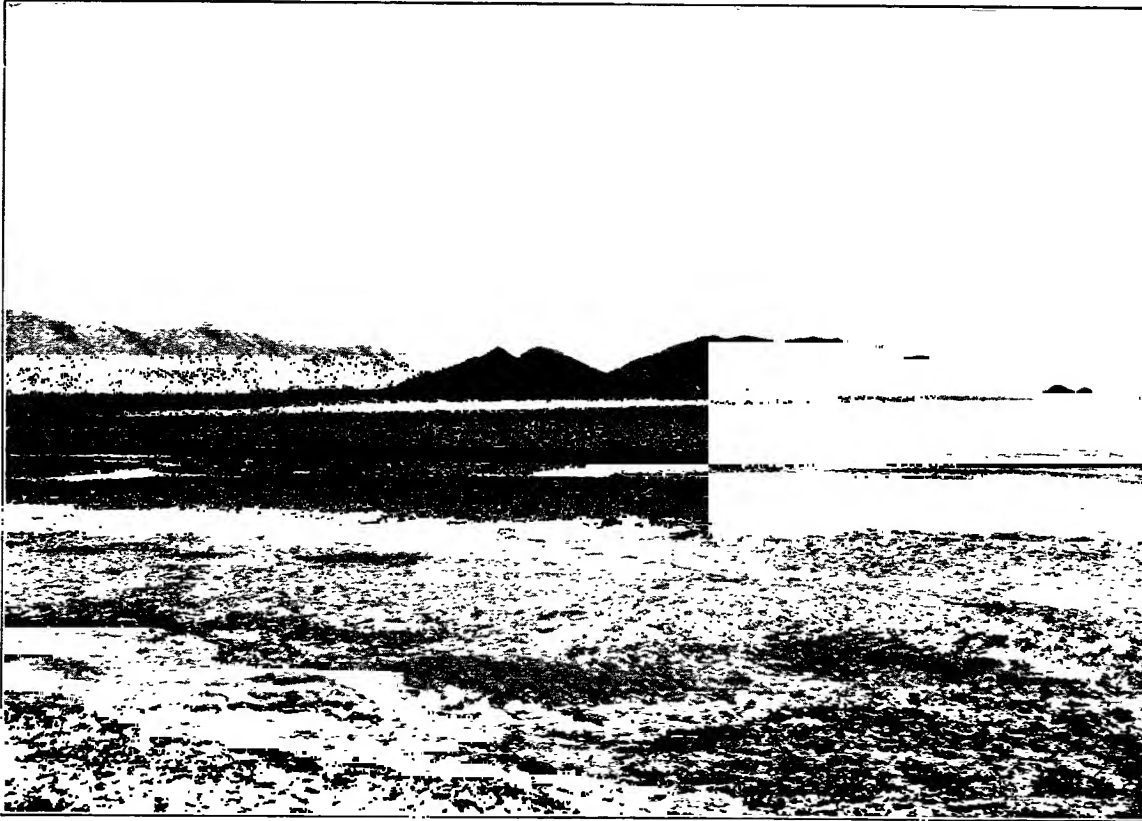


Fig. 324. LOOKING N  $37^{\circ}$  E FROM CAMP IX.

600 m. The pass, on which the Kar-jaghdi originates, is 4079 m. high, and forms a slight and comfortable swelling, but so flat that it is not easy to determine the actual water-divide. From its summit we perceived two glens, one running to the south-east, and another, running N.  $80^{\circ}$  E., wide and open, and bounded on the north by a crest, upon and above which rises the great dominating mountain-mass I. We followed the former of these glens, which are separated by a detached, and not particularly lofty, range. Perhaps it would be orographically more correct to look upon this range as a direct continuation of the rocky ridge which borders the glen of Kar-jaghdi on the south, and which in that case is pierced by the glen running south-east. By this last we went slowly down towards the broad latitudinal valley which forms the westward continuation of the Tschimen valley. Even from the upper

part of the glen we commanded a magnificent and extensive view across the southern border-range of the great valley, the Piaslik being visible from end to end of its course in the south and south-east, though it was then covered with snow. From the great massive I a side-glen runs down northwards, like the one we were following and parallel to it; this debouches somewhere in the locality of Ghischa.

The glen by which we descended was short, but rapidly widened out, and we soon emerged upon the *kakir*, i. e. the hard gravelly scree with an exceedingly gentle downward slope. We pitched Camp IX in the bottom of the latitudinal valley, where an insignificant brook was meandering backwards and forwards along a broad, shallow eroded watercourse, with small patches of grass on its banks. On the left bank we found hard scrub growing, and it supplied us with fuel.

Apart from the red sandstone at the former camp, we nowhere saw hard rock; the ground consisted everywhere of soft materials, — earth, *débris*, and sand. There was a considerable quantity of snow round about the pass, forming continuous sheets a decimeter deep, but owing to its thawing the ground was soft, oozy, and slippery. But in the glen by which we came down from the pass there was no snow at all; and the little rivulets that trickled down from this glen soon ceased, disappearing amongst the *débris*. This mountainous country is much more winter-like in the end of May than it is in the end of October. During this latter month the Piaslik for instance is practically quite free from snow. The grazing too is a good deal worse in May than in October; it is what is left over from the autumn, but has been for the most part cropped close by the kulans. Camp IX was situated at an absolute altitude of 3800 m. At that elevation the frost at night was quite noticeable, namely  $-6.5^{\circ}$ , so that in the morning the ground was frozen hard.

The large eroded watercourse beside which we made Camp IX comes from the S.  $66^{\circ}$  W., and originates in Kosak-kakti, that is the pass in the western part of the Tschimen valley that forms the water-divide between the Tschimen-köl and the Tschertschen-darja. This pass, situated only 279 m. above Camp IX, that is to say above the bottom of the latitudinal valley, is invested with great orographical importance as the water-divide between the basin of the Tarim and the Tschimen valley. It occurs in the long imposing range the eastern end of which is known as the Akato-tagh, and which culminates in the Ilve-tschimen, while farther west it borders the glen of the Tschertschen-darja on the north.

By means of this journey across the northern border-ranges of Tibet I succeeded in gaining a tolerably clear general idea of the situation which the Tscharklik-su and neighbouring streams occupy amongst these mountains. The long south-west to north-east branch of the river, which is shown on the map of the Russian General Staff, and from it has been transferred to all other maps of this region, is purely imaginary: there is nothing in nature to correspond to it in even the remotest degree. There exists no stream at all running from south-west to north-east; but there do exist a vast number of glens running from south-east to north-west, and belonging to the Tscharklik-su, the Tatlik-bulak, and the river of Vash-schahri, and between these again there are several small secondary glens. On the whole the main glen of the Tscharklik-su runs west-north-west, while its side-glens, all of which enter the main glen from the left, run north-west. We found a precisely similar arrangement at Dschahan-saj in the end of November of the year before.



*L'huir. A. R. Lagreins & H'osphat.*

ON THE WESTERN SHORE OF AJAGII-KUM-KÖL.



## CHAPTER XXV.

### FROM THE KUM-KOL OVER THE ARKA-TAGH.

May 30th. We crossed south-eastwards over the wide space between our watercourse and that which proceeds from the Toghri-saj, being at the same time the main stream of the latitudinal valley. The ground was barren, and hard, consisting of coarse sand, furrowed at intervals by small rivulets. The watercourse of Toghri-saj comes from the S.  $22^{\circ}$  W., and proceeds onwards towards the N.  $40^{\circ}$  E., and gives every indication of carrying sometimes a considerable flood; though at this time its volume was only about 5 cub.m. in the second, and that was split up into a number of brown muddy arms distributed over its broad, shallow bed. This last is nevertheless contained within sharply defined terraces. In the east-north-east we saw the little foothills that rise at Ghischa, the place where the latitudinal valley contracts to its narrowest; though it also narrows towards Kosak-kakti in the west.

From the bottom of the latitudinal valley we slowly ascended by a transverse glen in the Piaslik range, the next glen on the east to the important breach of Toghri-saj, with which we became acquainted the preceding autumn. The grazing here was very scanty, and water also was wanting, while the quantity of snow was exceedingly small, only the loftier parts of the mountains being white. We pitched Camp X at a spot where japkak was growing, at an altitude of 4078 m.; thus we were at exactly the same altitude as the pass of the preceding day. The rocks consisted of a hard, fine-grained green schist, much folded, and of quartzite. On the whole however the mountains exhibit rounded outlines, and are built up of loose disintegrated material. The mountain scenery had therefore assumed an entirely different character. In the Astin-tagh, in the transverse glen of the Tscharklik-su, the scenery was characterised by wild, fantastic cliffs, bare hard rock, with a pronounced vertical relief. Here however it had assumed the aspect of the common Tibetan type, namely rounded outlines, long rolling undulations, slight vertical differences, a preponderance of soft disintegrated material, and but very little hard rock. Wild yaks and orongo antelopes now began to make their appearance, but apart from them hares and ravens only. It blew pretty crisply from both east and west, the sky was for the most part clouded, and sometimes snow fell, with a little hail.

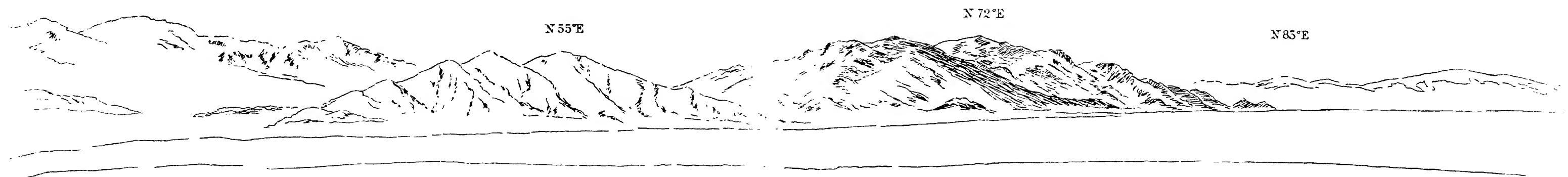
June 1st. From Camp X we ascended yet another 80 m. as far as a little easy saddle or pass, which is orographically significant only as forming the water-divide between the big latitudinal valley on the north and a very small self-contained basin on the south; the latter being a tiny cauldron-shaped depression, with a miniature lake in the middle, or rather a large pool, no doubt formed from the snows of the last few days. The range of Piaslik, which borders this little basin on the south, is crossed by a pass of precisely the same absolute altitude as the preceding pass, namely 4159 m. South of it we travelled diagonally across the western part of the latitudinal valley between Piaslik and the Kalta-alaghan, passing on our right, that is to the west, what appeared to be a free-standing butte, but which may very



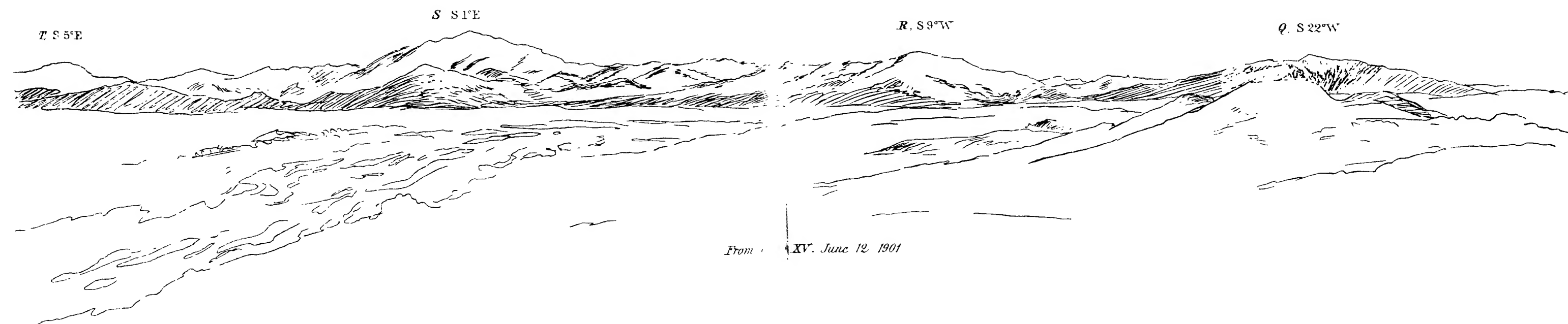
Fig. 325. LEAVING THE KUM-KÖL PLAINS.

well have been merely an offshoot or spur of some mountain-range or other. The rather large, open glen which lies on the southern side of this butte was stated by my guides to run towards the west-south-west and to enter the Toghri-saj, a statement I am unable to control, though it seems to me not improbable. In the upper part of this glen there is thus a saddle, which separates the water that flows down to the glen leading into the Toghri-saj from that which enters the flat, irregularly shaped depression which we were then crossing over. That this really is a self-contained drainage-basin appeared to be evident from the rather extensive area of moist, flat sedimentary ground which we passed close on our right hand, and towards which the then dry watercourses converge. This depression is bordered therefore on the south by the Kalta-alaghan, which we crossed by means of a pass 4326 m. high, the highest point we had attained since leaving Tscharklik. The level alluvium in the bottom of the depression was coloured red from the mountains of red sandstone and conglomerate, very friable and much disintegrated, that shuts it in all round.

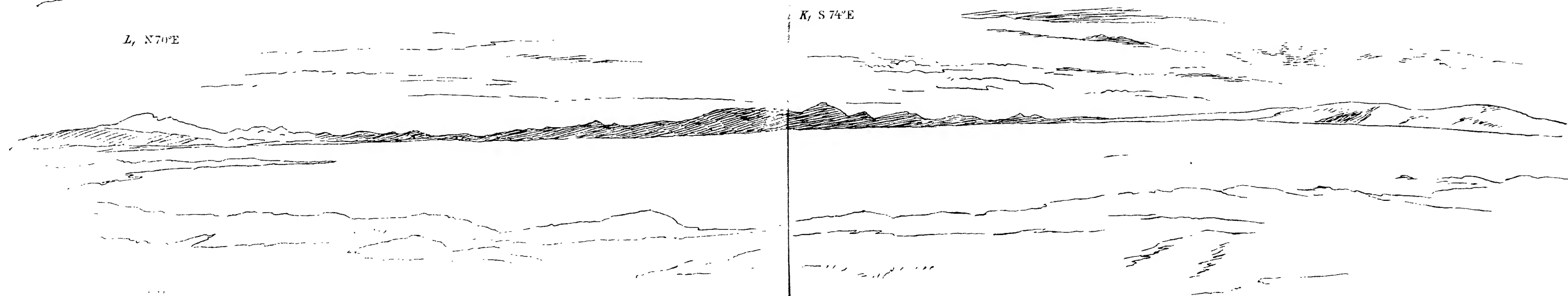




*The isolated mountain at the NE end of Lower Kum-köl from Camp XI June 4 1901*



From *XV. June 12 1901*



*Salt Lake as seen from Camp XXXV Aug 27 1900*





Pl. 76.



*Ljost, A. B. Lagredina & Westphal.*

ON THE WESTERN SHORE OF AJAGI-KUM-KÖL.



From the top of the pass the ground falls away gently towards the basin of the Lower Kum-köl. At first we kept to a glen of moderate size, then after crossing over a small saddle, we continued our march down a second similar glen. Both are bordered by soft, rounded offshoots from the ridge in which the pass is situated, and which itself forms a westward prolongation of the Kalta-alaghan. After that we steered our course towards the south-east, passing on the left, that is the north, the entrance to the big, broad latitudinal valley by which in November we had travelled to Kum-bulak, namely the valley which intervenes between the Kalta-alaghan and the Piaslik or Tschimen-tagh. This valley appears to be directly continuous with the self-contained basin I have just described, though between the two there must be a flat saddle or threshold. The glen that we now left on the north is a transverse glen through the Kalta-alaghan, and affords a passage to the river that we found in the western part of the latitudinal valley. Towards the west the Kalta-alaghan comes to a rather sudden end, though it is continued by a minor, detached butte. Through the gap between the two we again saw the snow-capped crest of the Piaslik. Here, as at Kum-bulak, its relative altitude appeared to be rather insignificant, owing to the fact that the latitudinal valley just mentioned lies at such a great absolute elevation. As we advanced away from the mountains the country grew more and more open, the surface sloping at a remarkably gentle angle towards the south-east. In front of us we now perceived the two small detached buttes which we had noticed in our November excursion. It was at the eastern foot of the eastern butte that we then encamped (see Atlas Pl. 44); we were now approaching the western one at an acute angle, having it pretty close on our right. It forms a short and rather low crest, stretching east and west. On the left we passed another small detached butte, lying east of the principal mass, and thus marched as it were through a rocky gateway. And now we saw spread out before us the broad blue sheet of the Ajagh-kum-köl; to the left the Kalta-alaghan, its summit faintly white, formed an impressive feature as seen in foreshortened perspective. The country here was remarkably flat and open, such irregularities as do exist not impeding the view. The ground was hard, and excellent for travelling, consisting of gravel, coarse sand, and dust, and the farther we got down, the drier it became, for the brooks from the melting snows are not able to reach so far down. Generally the surface was quite barren, grass and scrub being rare. There is nothing to indicate which way the surface slopes except the beds of the dry watercourses. Thus there exists, north of the free-standing butte, a gentle swelling, from which a brook descends towards the north-east, hugging closely the northern foot of the small insular butte. From the same swelling a second brook runs towards the south-west, but this must evidently describe an arc round the larger butte, going south, south-east, and finally east. Kulans and orongo antelopes were numerous, though at this season lean, for the young summer grass had not yet begun to sprout.

At the spot where we encamped, quite close to the lake shore, there were no springs. We dug several wells, but the water they yielded was salt. One of the shepherds who had accompanied us from Unkurluk possessed however sufficient instinct to point out to us a place where he undertook to say we should find drinkable water, and he was right. We dug down through the sand until we came to

a deposit of blue clay, and there we struck water that was drinkable. It was probably thaw-water from the mountains, which finds its way into the lake by subterranean channels. Along the shore there was a narrow strip of grass.

The only two places in which we observed hard rock were, first, just above Camp X, where green schist and quartzite cropped out at  $60^{\circ}$  to the S.  $33^{\circ}$  E., and, secondly, at the last of the buttes, where a dark violet mica-schist dipped at  $29^{\circ}$  towards the S.  $13^{\circ}$  E. The hard rocky skeleton of the mountains is becoming more and more hidden under the deposits of soft material. On the northern side of this peripheral region the disintegration products have been deposited over the gigantic area of the Tarim basin. We were now entering upon that part of Tibet which is constituted of self-contained drainage-basins, in which all the disintegration products are retained, partly filling up and rendering shallower the basins themselves and partly burying and hiding the backbones of the mountains, so that they only crop out at intervals. The basin of Kum-köl is however too big for this disintegration material to have yet been able to bury the small detached buttes which still rise above it like islands. Similarly the Kalta-alaghan rises to such a lofty height, that the greater part of the range consists of bare rock. On the south too it is bordered by an immense range, the Arka-tagh, which again rises to much too great an altitude for it to be in any sense accessible to the masking of the disintegrated materials. But beyond it, still farther south on the Tibetan highlands, we shall soon be crossing regions in which none but the very loftiest ranges succeed in lifting themselves up above this universal ocean of weathered débris.

At its extreme western end, near Camp XI, the Kum-köl is about 5 or 6 km. broad and forms as it were a blunted bay, the shores of which are every bit as even and regular as the shores round the rest of the lake. By means of a short reconnaissance I ascertained that that part of the shore which stretches between the camp and the eastern butte has just as regular an outline, the only diversity being a couple of miniature peninsulas and bays, and a couple of lagoons quite close to the shore. The spring beside which we encamped in November yielded a little water even now, but the small quantity of grazing which we found then had in the interval mostly been eaten off by kulans. The eastern butte screened the view of the northern shore only; the southern shore, with its low heights, was visible for a good way to the east, but eventually it died away in the far distance. To the east no land was visible at all, and this is just what one would expect, for the country between the upper lake and the lower lake is wonderfully flat.

After the entire caravan was collected at Camp XI, we continued our journey southwards on the 6th June, our immediate goal being the Arka-tagh. At first we marched along the shore, which was hard and level, with a scanty sprinkling of grass. Upon reaching a little freshwater spring we were forced to quit the shoreline, owing to the existence of treacherous lagoons and marshes. These are caused by the entrance into the lake of several small brooks and streams from the south-west; in some of them the water was perfectly fresh. Our course from the lake made an acute angle with its southern shore, and we soon lost sight of its waters; and then making our way across a rather flat steppe of köuruk and teresken, we steered south-east towards a glen, or rather a breach, in the low range which rises

some distance back from the shore. This steppe was crossed by a river coming from the south-south-west and carrying 1 cub.m. of water in the second, thick and muddy, and of a red colour, and divided into several arms. The first offshoots and spurs of the low ridge that we soon crossed over consisted of very powdery, soft yellow earth, perfectly dry, into which our caravan animals sank deeply as they tramped along. Below these hills stretch an expanse of marshes, showing open water here and there. The water in them was salt, and they appeared to extend right down to the southern shore of the lake, making a flat region which would be entirely inundated if the surface of the Kum-köl were to rise ever so little. But this shore region presents an insuperable barrier to the traveller, except possibly



Fig. 326. VIEW FROM CAMP XII.

in winter. Farther on, after we began to march east along the northern foot of the ridge, we found it excessively tiring to advance over the loose powdery surface. The ridge itself consists exclusively of the same formation, and is so wanting in stability that it would not be surprising if the whole were to be washed away together by some violent rain or other. Its flanks are scored with gullies and water-courses, some of which had in their lower reaches a tiny rivulet edged with white salt. The rivulets, along the line where we crossed them, were generally not more than a foot or half a foot broad, and about twice that in depth, so that they are rather deeply sunk in the soft formation. All make their way into a larger lagoon, situated amongst the flat hills, and filled with intensely salt water; from which it is to be inferred that it does not send out any emissary to the lake, but rather, on the contrary, sometimes receives salt water from it.

We reached the flat pass on the top of the little ridge by means of a shallow, gently sloping glen, which exhibited no signs of flowing water. On the top the

surface was somewhat harder. Our descent over on the southern side was stopped by a watercourse deeply cut in the soft ruinous mountain *débris*, the banks of which went down very abruptly, indeed they were mostly perpendicular. The stream, amounting to a volume of a couple of cubic meters of intensely salt water, the margins of which gleamed white with salt, is clearly a left-hand affluent of the main stream which issues out of the Arka-tagh to the south, — a stream the existence of which is witnessed to by Roborovskij, for he crossed over it twice, and on his map gives it the name of Sasik-jar. This name means the Stinking or Evil-smelling Stream, and would seem to allude to the undrinkable water in its lower part, for higher up its water is quite certainly fresh. None of my men was acquainted with this name, which for the reason stated seems to me to be probably correct. It is self-evident that the whole of this salt-impregnated region is absolutely barren. In the bottom of the deep, narrow, glen down which this stream flows we found no trace of either gravel or sand, nothing but yellowish red mud, which made it exceedingly difficult, and



Fig. 327.

even risky, to carry the caravan across it. The camels indeed sank in up to the knees and were very nearly swallowed up in the mire. The ford lies 48 m. above the surface of the Lower Kum-köl. By means of an especially steep and rugged little gulley we made our way up to a flat pass in the next spur, which is built up of the same soft and powdery formation. This pass is only 43 m. above the bottom of the glen. On its southern side it sends down another east-west contributory glen to the Sasik-jar, it too squeezed between steep sloping walls of reddish-brown earth, but without water. The heights on both sides of it are modelled into the most fantastic shapes, such as houses, walls, towers (fig. 327), so that the relief is both diversified and sharply accentuated, though the scenery itself is inconceivably dead and desolate. This glen is joined from the south by a meridional side-glen, containing an eroded watercourse without water. We encamped in the upper part of this in a tract that yielded a little wretched grazing; and although we marched 38 km., we failed to find any drinkable water. We dug a well in the bottom of the watercourse, but it was not until the following morning that it yielded anything; however in the evening a little snow fell. The upper layer in the actual bed of the stream consisted of coarse sand, resting upon clay. Below 87 cm the ground was frozen, but not above that. The water trickled out at a depth of 99 cm. In this region (alt. 4002 m.) the ground at a depth of 1 m. is probably frozen all the year round.

In this stage it would thus be impossible to speak of hard rock. It was easy to see however that the heights here had once consisted of red sandstone, and in

one place, where some loose and brittle flakes projected above the otherwise greatly pulverized soil, the rock appeared to have dipped  $78^{\circ}$  S., but I was unable to satisfy myself whether this was the actual dip or was only accidental. There is much gypsum and salt amongst these ruined mountains.

June 7th. Ascending a little flat glen, we debouched upon an extensive plateau, sandy, hard, and excellent for travelling upon, with a thin sprinkling of jak-kak scrub, and furrowed by kulan tracks and local rivulets, though almost entirely level, or with extremely small and flattened undulations. On the south the plateau is bordered by a low ridge and its ramifications. To the east the country appeared to be leveller and easier; but I preferred to travel round these hills on the west side so as not to approach too closely to Bonvalot's route. At the northern foot of the mountains, or rather amongst a labyrinth of small hills which exist there, we came upon one of the contributory glens of the Sasik-jar, running north-east and containing a thick, reddish, muddy stream, but perfectly fresh. Here, on its left bank and in an open space encircled by low hills, we pitched Camp XIII. At 1 p.m. a gale sprang up from the west, the wind blowing at the rate of 11 m. in the second, and this was followed by a lively fall of snow. The latter produced a peculiar effect upon the stream, in that the volume dwindled to a trifle, while the water acquired a peculiar flavour that made it undrinkable. The altitude here above sea-level was 4058 m. Hence the ascent from the lake is very gentle, seeing that its surface lies at an altitude of 3867 m. Between the region where we then were and the Atschik-köl there must exist a flat swelling with a ridge that acts as a water-divide, separating the water that flows westwards from that which flows eastwards, that is to say to the Atschik-köl and Sasik-jar respectively. From this ridge the surface falls away east and north to the Sasik-jar and the Kum-köl.

On the 8th June we travelled only 10.7 km., partly towards the south-south-east, partly towards the west-south-west, traversing a district which my men called Min-bulak, or Thousand Springs, a name which appears on Roborovskij's map also. Although the distance was but short, this stage proved to be one of the most tiresome of the entire journey. Upon leaving Camp XIII we struck southwards up a scantily grassed glen, shut in by hills of red argillaceous sand, capriciously and strangely modelled, giving the scene the appearance of an ancient ruined town. The going here was still pretty easy, for the grass, scanty though it was, nevertheless imparted a certain measure of firmness to the surface. Hares were numerous; as also were the tracks and droppings of wild yaks and kulans. The slight amount of moisture, derived from the snowfall of the day before, in no way inconvenienced our march.

But gradually the surface proved more and more unfavourable. A host of rivulets gathered into a larger gully running north, and finally entering the water-course beside which we pitched Camp XIII. Continuing up this glen, which had appeared so easy and inviting when viewed from a distance — as I saw it from an eminence it appeared especially flat or but slightly diversified. But in point of actual fact this district turned out to be of the very worst description possible. The transient torrents, scooped relatively deep in the soft argillaceous sand, run incredibly close together, the space between them often being only a decimeter. Thousands of these tiny rills would gather into a large rivulet; and these would form furrows or dry

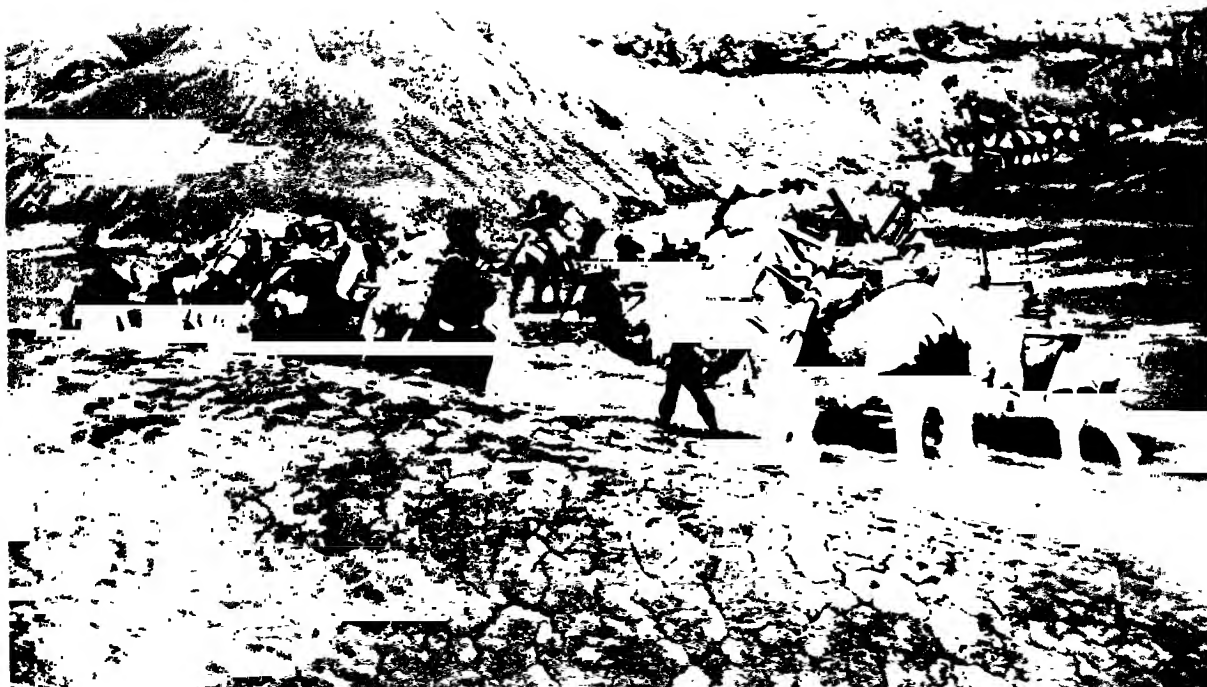


brooks of a yet higher order; and these again fell into the glen we were marching up; while the glen itself is inclosed between steeply descending slopes of sheer soft clayey mire, where it was utterly vain to look for a firm spot on which to place a single foot or hoof. To walk across ground of that description is as if one were marching with soles of lead or with iron weights fastened to one's boots. In the bottom of the watercourse it was even worse, for at every step both men and animals sank deeply into the mire. Down the main watercourse flowed a brook, making the ground softer still.



Fig. 328. A GLEN SOUTH OF KUM-KOL.

The relief forms in this region bear no slight resemblance to that part of the Akato-tagh which we crossed over north of the Ghas-köl. There also the mountains consist of layers of soft crumbling clay, which, scored by countless gullies ranging in size from the minutest groove up to actual glens, look for all the world like ship's planks bored through and through by worms. And yet there exists a very great difference between the two regions. The flanks of the Akato-tagh are as dry as tinder, and it is vain to search for a spring amongst them. Here on the contrary, at Min-bulak, both mountains and hollows are saturated with water, so that they are as wet as a sponge. This difference, which is due to the climate, gives rise also to an essential difference in the inner consistency of both mountainous regions. Amongst the soft argillaceous mountains of the Akato-tagh the original bedding of the decayed clay strata could be distinctly recognised without any other displacement except such as was occasioned here and there by a rare and chance rain. But amongst the red arenaceous clay hills of Min-bulak it would be labour wasted to search for even the slightest indication of stratification. They form a perfectly amorphous mass, a gigantic mess of porridge turned unceremoniously out of



THE DIFFICULT GLEN SOUTH OF AJAGH-KUM-KÖL.



*Ljustr. A. B. Lagrelus & Westphal.*

THE SAME.



the cooking-pot, exactly like the hills and heights which I have already described as existing in another part of Eastern Tibet. Even if there ever did exist any stratification or bedding it is certain to have become obliterated under the circumstances that prevail. After a continuous downpour, especially of rain, though it is also true of melting snow and hail, the whole of this slough of despond — it is by no means thick — becomes wet through, and then, in consequence not only of its own weight and the very slight degree of adhesion that subsists between its finest particles, but also of the softening and loosening effects of the water upon the surface, it must inevitably begin to slide down, at however slow a rate. From the summits of the hills, where the thickness of the formation as well as its weight are greatest, the pressure is propagated outwards, giving rise to a displacement and an extension all round. This movement and transference within the body of the mass take place extremely slowly, and become more and more retarded in proportion to the increasing flatness of the hill or ridge. In their present stadium the heights of Min-bulak are so small and so low, that the sliding movement is at a minimum, and exercises no noticeable effect upon the regularity and hydrographical position of the innumerable eroded rills, torrents, and watercourses. But it is easy to imagine these gullies, as a consequence of a sufficient sliding action or displacement, to be prevented from exercising their functions in the usual way.

It is however ruinous to a caravan to attempt to travel across a country such as that. We were forced to turn back and retrace our steps down the glen, although its bottom had been trampled still softer by the camels. At length we turned



Fig. 329.

west up a side-glen, the scarped terraces of which, consisting of the same soft material, were about 3 m. high and perfectly vertical (fig. 329). Once or twice, when we had to cross over it, our only alternative was to hack out steps on both sides with spades and pickaxes. In this glen there was no water, but it is nevertheless bordered by a number of contributory crevices of a peculiar shape; that is to say, they are often 1 dm. wide and 1 m. deep, or ten times deeper than they are wide. Crossing over an unimportant pass (alt. 4171 m.) in the neighbourhood, we reached a flat cauldron-shaped glen, surrounded by the usual low gentle hills, with a small pool in the middle of it. Its surface had a sprinkling of grass, and the meadows were traversed by a couple of small brooks, which ran off towards the north-west; this was said to be the actual Min-bulak.

Thus during the course of this day's march we came across no actual hard rock; the nearest approach to it was occasionally fine gravel and coarse sand lying on the outsides of the gentle hills. The only place where the bedding was distinct was on the hills immediately south of Camp XIV, the clay there being rather firmer, although even it crumbled readily between the fingers. Its dip was  $45^{\circ}$  towards the S.  $3^{\circ}$  W. One or two of these hills presented the appearance shown in fig. 330; one of them was covered with a layer of sand and gravel. Some grass grew on them, although very scantily and of very poor quality. All the country next to them on the south was perfectly soft and absolutely barren.

Nor did the characteristic Tibetan weather fail to put in an appearance, namely a violent wind from the west, followed by a copious fall of snow. A ridge visible to the west of Camp XIV was called by my guides Tekija-tagh, while to the south-west, but at some distance, was the mountain-range of Alialikning-tagh, which is however not especially high.

June 10th. Here we gave ourselves a day's rest; the air was as cold as in winter, the thermometer being only a few degrees above zero, while in the ensuing night we had  $12^{\circ}$  to  $13^{\circ}$  of frost. At the same time I seized the opportunity to send on pioneers to ascertain whether a road really could be forced through this inhospitable country with our heavily laden caravan. When we started south again, we travelled by the route these men pointed out to us. The hilly country that we first marched through is traversed by a network of small gullies, which gather into a larger watercourse, and this in its turn no doubt joins the nearest tributary of the Sasik-jar. The ground was however firm and bore us. With the object of avoiding the contiguous mountains on the south, we made a big bend to the south-east, east, and east-north-east, crossing over a little col at an altitude of 4268 m. In the

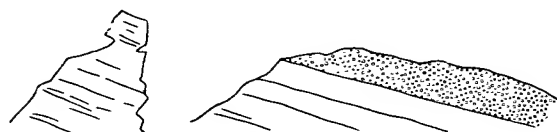


Fig. 330.

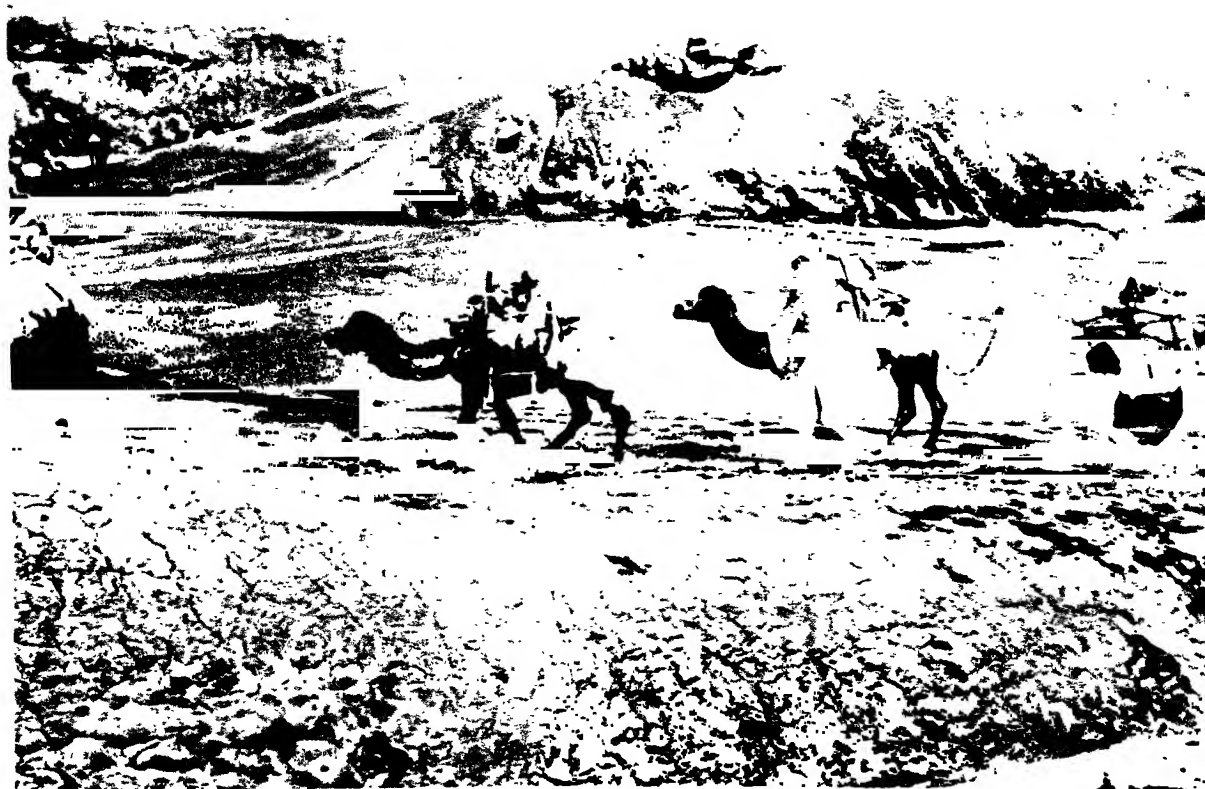
direction last indicated we were therefore descending, and kept to a flat, hollow-flanked ridge, bordered on both sides by shallow watercourses. When the ridge came to an end we continued down a shallow and easy glen, destitute of water, al-

though its bottom was moist; the ground was however hard and excellent for travelling. The hills thereabouts generally had a sprinkling of grass, and the great abundance of the droppings of wild yaks and kulans prove that they are a favourite grazing-ground for these creatures. The mountain-range which we now had nearest to us on the right, that is to the south, must be identical with — or perhaps it actually forms a part of — the range which borders on the north the self-contained drainage-basin of the Atschik-köl, the same range that we had already crossed over by a difficult pass a hundred kilometers farther west. It is the same range that we saw from Camp XIV; its name is the Alialikning-tagh. Snow lay in places on its northern flank; it sinks gradually lower towards the east and finally dies away altogether. When seen from the south it appeared to be a good deal lower than when seen from the north, this being due to the relatively great altitude of the Atschik-köl (4250 m.).

Upon reaching a conspicuous promontory of this range we were at length able to turn towards the south-east, and then crossed over quite a series of watercourses that originate on the summit of the extreme eastward portion of the main range and run towards the north-east. These watercourses, which are not very deep, are separated from one another by elongated, dolphin-backed, grass-grown hills. At that time they carried no water, and a little lower down debouched upon an especially large main glen going northwards, and beyond a doubt identical with the Sasik-jar; indeed I feel pretty certain it was its upper part. However we did not obtain a glimpse of this glen until we reached the top of a huge swelling of the surface, which lifts itself up to an altitude of 4166 m. We approached the left



THE DIFFICULT GLEN SOUTH OF AJAGH-KUM-KÖL.



*Ljustr. A. B. Lagrelus & Westphus.*

THE SAME.



eroded terrace of the glen at an acute angle, and travelled along it for a space, going south. Finally we encamped (XV) on the edge of almost a precipice overhanging the glen at an altitude of 4146 m. It was dangerous to approach the edge, for not only was it gapped with gullies, it was also hollowed by smaller streams from the eastern fork of the range. In the bottom of the glen was a not inconsiderable volume of flowing water, with here and there an extensive patch of ice, which despite the advanced season had not yet melted.

During the greater part of the day the prevailing rock was red and green sandstone, dipping  $72^{\circ}$  N., though very often the pitch was less. In consequence of being bedded at this angle the southern slopes of most of the hills are excessively steep, whereas the northern slopes have a gentler descent. During the latter half of the stage the dip was almost the opposite of that just noted, that is to say it became  $31^{\circ}$  towards the S.  $10^{\circ}$  W., the rock still continuing to be the same soft sandstone, embracing gypsum here and there. The great glen, which evidently gathers its waters from over a wide area, breaks through all these hills and mountains, all of which belong, at all events they originally did, to ranges having an east-west direction. Situated between the Arka-tagh and the Kalta-alaghan, they run parallel to both; but in them denudation and disintegration have proceeded so far that, in comparison with the towering mountain walls that border the basin north and south, they present the appearance of merely inconspicuous flattened, rounded heights.

From an eminence in the vicinity of the camp we obtained a magnificent view of the *terra incognita* which stretched out before us to the south. The principal object was a huge snow-clad range, extending east and west, and belonging to the Arka-tagh system, which it was our next business to get over. In the east we saw

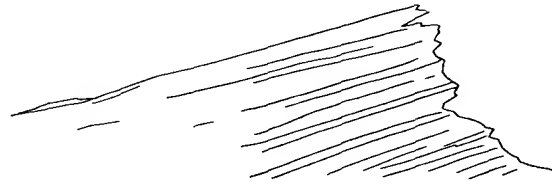


Fig. 331.

the western forks of two ranges likewise in part covered with snow; these we had crossed over in our excursion of the summer before. Possibly the range which I have just called Alialikning-tagh ought from the orographical point of view to be regarded as a continuation of the more northerly of these two ranges. But with regard to this question, as to others, I shall have an opportunity to return in vol. IV, when I proceed to discuss generally the mountain systems of Tibet, their orientation and their mutual relations one to another. As soon as my itineraries have been traced on a general map, and all my astronomical observations have been worked out, I shall be in a position to deal with the material as a whole.

Camp XV turned out to be quite close to the point where the great drainage channel is formed by the confluence of three glens coming from as many different directions, though all issuing out of the range to the south. One comes from the S.  $37^{\circ}$  E., and may originally have been a latitudinal valley between the southern snowy range and the next broken range to the north of it, although this cannot be decided with certainty. But at all events it clearly derives by far the greater part of its supply from the first-named range. The middle glen of the three comes from



the S.  $19^{\circ}$  W., and its upper part is entirely situated in the southern range. The third glen, which comes from the south-west, was the one we followed, so that we thus had an opportunity to become more closely acquainted with it.

In the neighbourhood of Camp XV the grass, considering the great altitude, was better than might be expected. Orongo antelopes and kulans were numerous; while wolves, hares, and ravens also occurred. We saw too a flock of wild-geese resting beside the stream; possibly they were on their way from their winter-quarters in India to their summer-quarters in the marshes of Lop. In this flat, open gathering arena the ground consisted exclusively of disintegrated material. The bottom of the watercourse was for the most part mud, excessively soft and treacherous, and the only places where it would bear were those that were strewn with gravel. The nearest hills were composed of the same soft materials as hitherto, but a little higher up the slope there was a somewhat harder sandstone, dipping  $38^{\circ}$  towards the S.  $20^{\circ}$  W. One of my guides ventured to assert, that a Mongol pilgrim road formerly led southwards through the main glen which we were now about to follow, and a »find» which we made at the next camp lent a certain colour of probability to the statement.

June 14th. From Camp XV we once more had a climb before us, namely a very gentle ascent towards the south-south-west. The going was easy and comfortable, and only seldom so soft as to occasion us any inconvenience. At first we kept on the left or west terraced bank, crossing an occasional contributory watercourse, none of them very deep. The opposite terraced escarpment is however steep or perpendicular, as well as energetically trenched by the side-glens that come in from the south-east. The main glen narrows as it climbs higher; in places sheets of ice were still remaining from the winter. Next to us on the right, or west, the country consisted of low undulating hills, slightly grass-grown, and of terraced elevations. A long way off in the east-south-east and south-east was a larger mountain-mass, probably belonging to the higher regions of the Petelik-saj.

At one point where we crossed over the stream, it carried the rather large volume of 10 cub.m. in the second, divided however between four larger and a number of smaller arms, distributed over the whole of its bed. Here also wild-geese were resting. After that we crossed over the middle of the above-mentioned feeding-glens, down which, although tolerably energetically developed, only a mere rivulet, perhaps  $\frac{1}{2}$  cub.m., was then trickling. The third subsidiary glen, farthest west, is the largest; this we left in the meantime on our right hand. The detritus scree, across which we were approaching the foot of the mountains, is hard and thinly sprinkled with gravel, and has a very gentle ascent up to the northern foot of the range. In front of us, to the south-south-west, was the entrance to a glen, backed at its upper end by the rather imposing, snow-capped summit of the range. On both sides of this glen-opening the hard rock again made its appearance in wild crags and cliffs, a green schist dipping  $33^{\circ}$  towards the S.  $37^{\circ}$  W. But even there, quite close though it was to the foot of the mountains, gravel and stones were almost entirely wanting; the disintegrated materials are very finely subdivided. The brook which issues from the outlet of the glen spreads itself out in several deltaic arms, the one farthest east being the largest. Here a big sheet of ice had formed,

but it was then melting; several tiny rills trickled away from it towards the north-north-west, though they were all too insignificant to be able to reach down to the main glen. Their water was of course perfectly fresh, like that of the principal stream, although we did find beside it one or two lagoons of brackish water. The ground around the ice-sheet was water-logged and deceitfully marshy. Over a limited area the grass was growing short and fairly thick.



Fig. 332. CAMP XVI.

Gentle though the ascent was, nevertheless within the 25 km. between Camp XV and Camp XVI we had climbed fully 300 m.; the altitude of the latter camp was 4452 m. We were approaching nearer and nearer to the stupendous altitudes of the Arka-tagh and the immense plateau of Tibet that lies behind it. Westwards stretched the big, broad, open latitudinal valley, with the main stream flowing down it. The transverse glen in the mouth of which we encamped appeared to be short and narrow, to rise rapidly, and to be difficult of access; being in this respect very unlike the meridional transverse glen we were to make trial of on the day following.

Wild animals were especially plentiful in this region; we saw several troops of kulans each containing about 20 individuals. On the dry grassy slopes the marmots make their burrows, and their enemies, the bears, are consequently not far to seek. We shot one of the latter at this camp. Partridges also were seen.

The traces of human visitation which we discovered at this camp were as follows — half a mill-stone cut out of a rock very like the adjacent green schist,

3 $\frac{1}{2}$  cm. thick and 32 cm. in diameter, with radial groovings for crushing the corn by grinding it against a similar but probably plain stone (fig. 334). My Mussulmans were positive that this implement was made by the Mongols. At the foot of the cliff were distinct signs of camp-fires, with ashes and *tesek*, or wild-yak droppings. Immediately west of the camp was a cairn of stones. These indications may of course be due to yak-hunters or gold-prospectors from Tschertschen equally as to Mongol pilgrims. A short reconnoitring trip up the transverse glen showed however that it was traversed by a track of some sort, for we found cairns of stones in not less than four places, though three of them had fallen down. But the track, such as it was, soon became lost amongst the mountains, and was quite impracticable, at all events for a heavily laden camel-caravan.

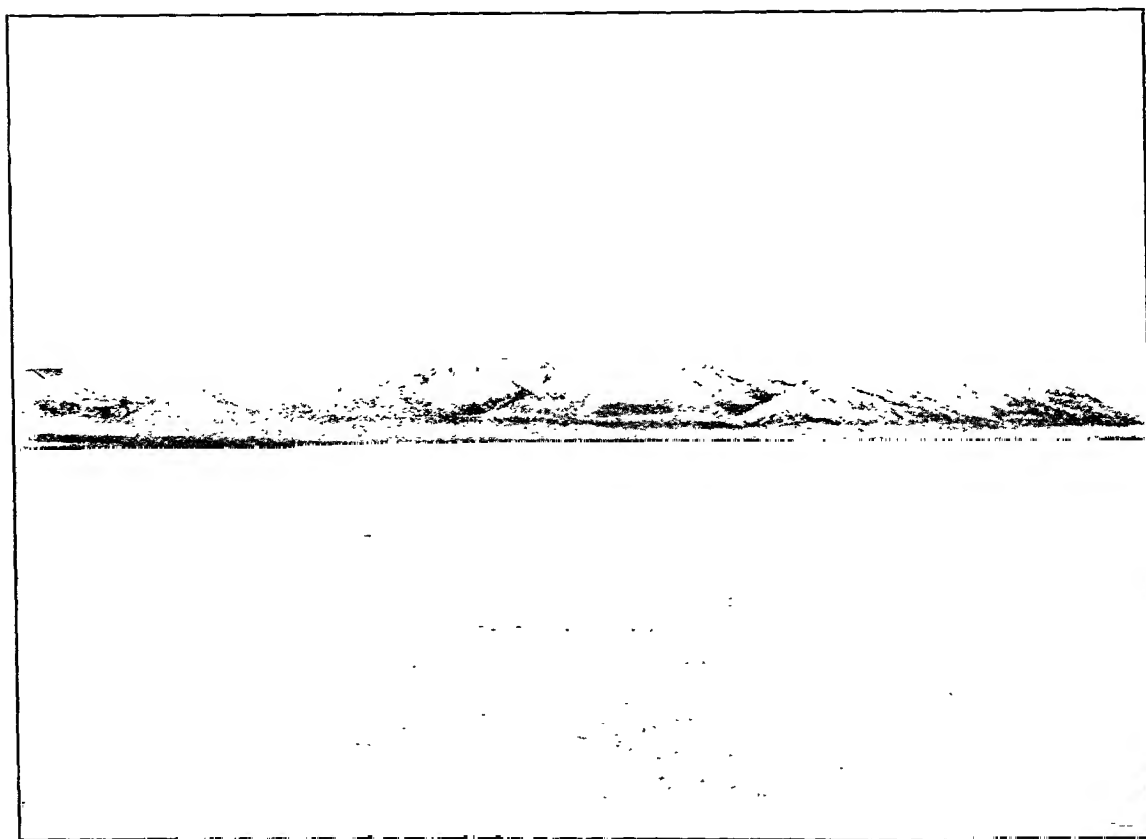


Fig. 333. DOWNWARDS FROM CAMP XVI.

On the 15th June it occasionally rained, and on the 16th snow fell so thick and fast that we never once attempted to make a start. The next day the weather was magnificent and there was bright sunshine. The snow remained only on the mountains, the bottom of the glen being practically quite bare and dry. Turning our backs upon this impassable transverse glen we tried its western neighbour, after having first reconnoitred it and found it suitable. But in order to reach its entrance we had to make a wide detour round a spur that juts out from the southern range; yet that past, we turned and marched due south up into the broad open entrance

of the transverse glen that we were making for. The ascent is fairly easy and evenly distributed. From off the encircling mountains, which are relatively low, various watercourses, then however dry, run together into a bigger one which enters the main stream of the great latitudinal valley, though *its* volume was then insignificant. Close to the point where this valley bends round towards the north and passed our Camp XV a large ice-sheet had formed from springs which trickle out in the bottom of the valley. The main valley lies east and west, and the mountains which border it on the north appeared, when seen from it, to be fairly low, and so continued as far as we could see towards the west. In that direction there must somewhere be a low pass, forming the water-divide between the basin of the Atschik-köl and this the actual baschi of Sasik-jar. In the same direction the main valley appears to narrow.

Our side-glen also contracts, until finally it is very narrow, and is bordered on its eastern side by fantastic pinnacled cliffs, frequently with precipitous faces. Apart from some sappy moss, there was practically no vegetation. Camp XVII was made beside a little spring at an altitude of 4668 m. Here there was a green schist dipping  $35^{\circ}$  N. Otherwise the entire day's march ran through soft formations, there being fine gravel in the watercourses only.

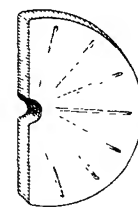


Fig. 334.

June 18th. All night long snow fell and the wind blew from the north-north-west; but we had now reached the high altitudes where it snows all the year round. In the morning the entire country was buried under a white coverlet; but it had already begun to melt away, as we could see from the swimming brooks and torrents, which came racing down from every direction into the valley stream; this last must then have had water even in its very lowest part. The brook that coursed down the glen, which we now began to ascend, had water clear as crystal, flowing over a bed of fine gravel. Here again the flanks of the mountains consisted exclusively of soft disintegrated material, with a few blades of grass, apart from which the only vegetation was mosses and lichens. We reached without difficulty the flat, regularly formed, and rounded pass; its altitude was 4779 m. Upon the top my Cossacks built up two mounds of stones; I mention this in case any European should in the future select this same road. Thus we had now crossed over this latitudinal range, which is quite certainly identical with one of the parallel ranges of the Arka-tagh system that we had already crossed over farther to the east. My observations in this region go to show, that it is not pierced by any of the head feeders of the Sasik-jar. The most important of these are on the contrary situated in the latitudinal valley north of the range, and thus flow latitudinally, one from the east, the other from the west, uniting immediately above Camp XV. The range in question is on the whole rather uneven, sometimes swelling up into stupendous craggy masses, as for instance above Camp XVI, and at other times being rather flat and relatively low, as at the pass by which we had just crossed over it. How far it continues towards the west it is difficult to say; but probably it is identical with one of the pierced ranges that we had to deal with south-west of the Atschik-köl.

The configuration of the range in the immediate neighbourhood of the pass suggested the inference, that several of the watercourses which we had seen on the north

side of the range have their origin in this and similar passes. At a greater distance towards the east there rose up on the contrary several great snow-capped peaks, probably the same which we had seen from Camp XVI. Immediately south of the pass was a minor spur of the range, which forced us to make a detour to the south-west. In this direction there was a little lake, then entirely frozen over; the mountains slope gently towards its southern shore. A considerable distance towards the south-west we observed a range, relatively not very big, which was wholly covered with snow; this was the principal crest of the Arka-tagh. Between it and the range on which we were then standing stretches a broad, open latitudinal valley, running



Fig. 335. DOWNWARDS FROM CAMP XVI.

east and west; and it is there that the little lake just mentioned is situated, forming a small self-contained basin, though it must of course possess an underground effluent, otherwise its water would not be fresh. We directed our march towards the eastern shore of the lake, descending at first by a very flat, shallow glen with a gentle fall; the dry brook that runs down it enters the lake at an absolute altitude of 4733 m. or only 46 m. lower than the pass, and it was there we formed Camp XVIII. There also the lake is joined by a rivulet from the east, probably fed by springs, for, notwithstanding the copious downfall of the day before, its bed was dry. The grazing was better than might be expected considering the great altitude. The surface consisted everywhere of soft material, extremely finely sifted;

that is, there was remarkably little fine gravel. It was only on the south side of the pass that the green crystalline schist cropped out in ribs barely a foot high, and dipping  $60^{\circ}$  towards the S.  $53^{\circ}$  W.

That we were not the first human beings to visit these silent, peaceful solitudes was proved by the fragment of an iron cooking-pot (see fig. 336). Its shape shows that it is not of Mussulman, but of Mongol, workmanship. This discovery too strengthens greatly the probability that at some time or other a Mongol pilgrim road really did run this way, although it is amazing that travellers ever should have chosen to traverse these parts of Tibet when there exists the easier, though it may be longer, route to Lhasa via Temirlik and Tsajdam.

On 21st June we covered a distance of 32.3 km. towards the south-south-west, and ascended another 200 m. We left on the right the little lake with its white and soft sheet of ice, which, strange to say, although it was the middle of summer, was still strong enough to bear a man. From the south-east the lake receives a couple of dry torrents, while a third, which enters at its southern extremity, brought some water.

The surface south of the lake slopes upwards at an extremely gentle angle, and although soft, it nevertheless bore. The grass thinned and practically gave out altogether. On the left we passed a little pool. Some kilometers south-west of it we rode over a river which carried 7 or 8 cub.m. in the second, the water being almost perfectly clear. At the ford the bottom was so soft that we had to exercise the utmost caution. The stream is however very superficial, and its banks are not very accentuated. It receives numerous tributaries from several directions, but its actual main channel comes down from the north side of the Arka-tagh. At the point where we forded it, it changed its direction from south-south-

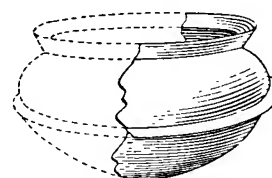


Fig. 336.



Fig. 337. APPROACHING THE ARKA-TAGH.

east to west-north-west. Where it goes to eventually I cannot say; although I should have been strongly inclined to believe that it pierces by a transverse glen through the range we had last crossed over, had we not found the latitudinal valley to the north of it almost destitute of water. Perhaps it is the upper part of some stream that empties into the Atschik-köl, only that this supposition seems to be less probable than the other. So far as we were able to see, the river continued to follow the latitudinal valley that lies immediately north of the main range of the Arka-tagh towards the west-north-west; and from it we obtained an extensive view of the range on the north side of it. It now appeared that the pass by which we had just crossed over that range belongs to a relatively low gap in its summit, for both east and west the range swells up to a considerably greater height. In these high altitudes one is easily deceived as to both horizontal and vertical dimensions. When viewed from Camp XVIII, the Arka-tagh had appeared to be quite close, and yet it took us more than a long day's march to reach its foot. As now seen from the bank of this new river, the same range appeared to be especially flat and insignificant, and yet when we came to tackle it the next day, it cost us the utmost efforts to surmount it successfully. The reason the range seems to be so low is simply that the river itself lies at an immense altitude. When however the Arka-tagh is studied from any of the passes of the Kalta-alaghan, it appears to tower up like a stupendous snow-white wall, the top of which vanishes amongst the clouds; but in that case the observer has between himself and the Arka-tagh the relatively deep and spacious basin of Kum-köl.



Fig. 338. APPROACHING THE ARKA-TAGH.

The route which my pioneers had chosen for us led across flat hills, threaded by some smaller brooks on their way down to the principal river. On the other side of these hills we struck into a broad, shallow glen coming south-west from the Arka-

tagh, and down it coursed a small torrent, which however soon entered the principal river. We made Camp XIX (alt. 4937 m.) at the point where this glen begins to contract, just before starting up to the crest of the Arka-tagh. On the soft hills that stud its left side we again found a little grass, though of the wretchedest description. Not only was it excessively scanty, it was also yellow and hard, in fact more like short nails sticking up out of the ground few and far between. As fodder it was almost completely worthless; it merely gave our caravan animals a little exercise during their night's rest.

On the 22nd June we pushed on farther up the glen, the brook in which was now running pretty strong. The summit of the Arka-tagh was shrouded in impenetrable clouds, which all day from the morning continued to discharge uninterruptedly vast quantities of snow and hail, at the same time that the wind blew a hurricane from the north-west. In consequence of the blinding snow I missed some of the details of the landscape, while all hope of obtaining a more extended view from the top of the pass was effectually dashed. During this present series of journeys I crossed over this part of the Arka-tagh on three separate occasions, in spring, summer, and autumn, and on each occasion there was a downfall; the only time I have crossed the range under favourable conditions was in 1896. Thus the Arka-tagh acts as a focus of attraction to such atmospheric moisture as has been able to get past the other great upheavals of the earth's crust round about it; but then this range reaches considerably higher altitudes than any of its neighbours. And even though the other Tibetan ranges farther south often reach a greater height than the Arka-tagh, they do not possess the same compact and extensive development.

Even at noon it was twilight. We felt as if we had got astray in a world not meant for human habitation, where indeed all traces even of animal life had come to an end. The wild yak actually seems never to visit these regions, not because it finds them too cold or too snowy, but simply because they have no pasturage to offer it. If ever it does come there it is only in the course of its migrations to and fro between the Tibetan highlands and the self-contained drainage-basins north of the Arka-tagh. The glen up which we were marching was absolutely barren; both its slopes and its bottom were entirely buried under a continuous sheet of snow, which continued to increase in depth as the snow came floating unceasingly downwards out of those heavy, leaden clouds, enveloping all the mountains and filling up all the glens and valleys. The stream, which in consequence of the slowly melting snow, was running with a fairly strong current, made a dark winding ribbon flung across the eternal whiteness of the scene. Its bed contains a good deal of gravel, consisting for the most part apparently of green schists. There were no treacherous or swampy spots; on the contrary the ground was everywhere hard and firm.

At length we reached the point where the gentle and regular ascent came to an end, and a steep acclivity faced us leading up to the actual pass. In my popular work I have given an account of the inconceivable efforts it cost us to force our way over this culminating portion of the climb. Not only did we lose five camels, but the strength and powers of the caravan were tried to the uttermost. A steep, but shallow watercourse showed us the way up to the pass. This forms



a rather broad dome-like arching of the crest. Here the snow lay very deep everywhere. The altitude above sea-level was 5189 m. Thus we had climbed 252 m. since leaving Camp XIX; but the notable thing is this, that when you are already at an altitude of 5000 m., even the slightest further ascent costs you tremendous exertions; every additional ten meters at that altitude are as difficult to accomplish as a hundred meters at an altitude of 2000 m.



Fig. 339. FIRST CAMP SOUTH OF ARKA-TAGH.

There was neither cairn nor any other sign on the pass to indicate that it had ever before been visited by human beings. It is situated in a severely weathered and denuded, as well as rounded, part of the Arka-tagh. We could not however see very far in any direction in consequence of the whirling snow. In the vicinity of the pass the range seemed to extend towards the south-west, not in wild jagged peaks and cliffs, but still in rounded, dome-topped masses. In fact, these broad, flattened summits, of uniform elevation, are characteristic of the Arka-tagh. The difference of height between the pass and the adjacent summits is slight, not more than one or two hundred meters; parts rising to any considerably greater altitude than the pass are an exception. This was however the case on each side of the pass which I selected above the springs of Kara-muran in 1896. I shall have a further opportunity to analyse this circumstance when I come to discuss the general orographical relations.

In the immediate vicinity of the pass I did not perceive any hard rock. At Camp XIX there was a friable, weathered argillaceous schist dipping  $27^{\circ}$  towards the S.  $3^{\circ}$  E., and at Camp XX a hard crystalline schist with a dip of  $63^{\circ}$  towards the N.  $15^{\circ}$  E. But between these two points hard rock cropped out nowhere within range of vision. On the pass itself the ground was even so soft that we sank into it, even where it was covered with snow to the depth of a foot.

The descent on the south is gentle and easy, but the flatter the ground the more abominable it became, and in several places it actually threatened to swallow up the caravan. We all had to get off and walk, and feel our way with the utmost circumspection. Of the general morphology I was unable, owing to the unfavourable weather, to obtain any clear impression. We crossed over a whole series of small rivulets and brooks, all making for the south-east, where they doubtless cooperate to give rise to a larger stream, which, as usual, will disembogue in some lake. We pitched Camp XX beside one of these brooks at the northern foot of a chain of hills, on which there were no traces whatever of vegetation. Here, thanks to the disintegrated gravel, the ground did bear the weight of the caravan. When looked at from this camp, the altitude of which was 5091 m., the Arka-tagh presented the appearance of a stretch or ridge of rather low heights; but then the difference of altitude between the camp and the pass was barely 100 m.

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## CHAPTER XXVI.

### TRAVELLING SOUTH FROM THE ARKA-TAGH.

June 23rd. The ground being altogether unreliable towards the east, we were forced to ascend towards the west, following the little flat glen in which we were encamped. The ascent was unnoticeable, and we soon found ourselves on a low pass and water-divide only 35 m. higher than the former camp. Here again we discovered traces of the visits of man in a landmark erected on the summit of the pass, namely a large stone with a circle of smaller ones set up on edge all round it. During the night the ground had frozen and we were marching as it were on thin ice, which every moment threatened to break under our feet. The ground underneath the frozen crust was as soft as porridge, and as the day wore on the camels began to trample through more and more frequently. On the west side of the water-divide stretched a very small self-contained basin, with two little freshwater lakes or rather pools in it, into which the thaw-water was gathering off the circumjacent heights. Both lakes were covered with thick ice. And also on the east side of the little ridge that we were marching round we saw in the distance two similar miniature lakes. Afterwards we still continued to ascend, but so slowly that with the naked eye it would not have been possible to determine in which direction the ground sloped, had it not been for a tiny rivulet. This we followed towards the south-south-east; on its left side rose a minor snow-clad ridge. Here the surface was strewn with gravel and was somewhat harder. On the right side there were yet lower hills with a slight sprinkling of grass. Across them we marched, passing one of the several frozen pools which exist in that locality, occupying the small depressions in the somewhat broken ground. There was no hard rock in sight, but on the ground lay pieces of black tuff, with a number of large vesicles disseminated over their surface. Camp XXI had an altitude of 5109 m., and consequently lay only 80 m. lower than the pass of the Arka-tagh. The weather was now again bright; and far away in the south-east we saw a stupendous snowy mass, no doubt a link in the great mountain-range which comes next to the Arka-tagh on the south and runs parallel with it. Farther to the east the Tsajdam Mongols call it Koko-schili, or the Green Hills, a modest name for such an immense upswelling of the earth's crust!

June 24th. Instead of travelling due south, it was now my purpose to make a detour to the west, in order to visit the lake on the southern shore of which we



*Lynstr. A. B. Lagrelus & Westphal*



had pitched Camp LXI the year before; this would give me a valuable point of control by which to connect the observations of the two itineraries. But we had to keep on south for yet one day longer, before we hit upon suitable ground, that promised a favourable track to the lake. During this day the country remained on the whole fairly flat and plateau-like, though rather greatly diversified on a small scale, which necessitated our going incessantly up and down the little hills and swellings. These still continued to be everywhere plentifully strewn with pieces of tuff, and they somewhat retarded our advance. We were now on the high uplands where the scenery changes so slowly that the caravan, when contrasted with the mountains, seemed to be almost standing still. Orongo antelopes and partridges were fairly common. A little grass grew in places.

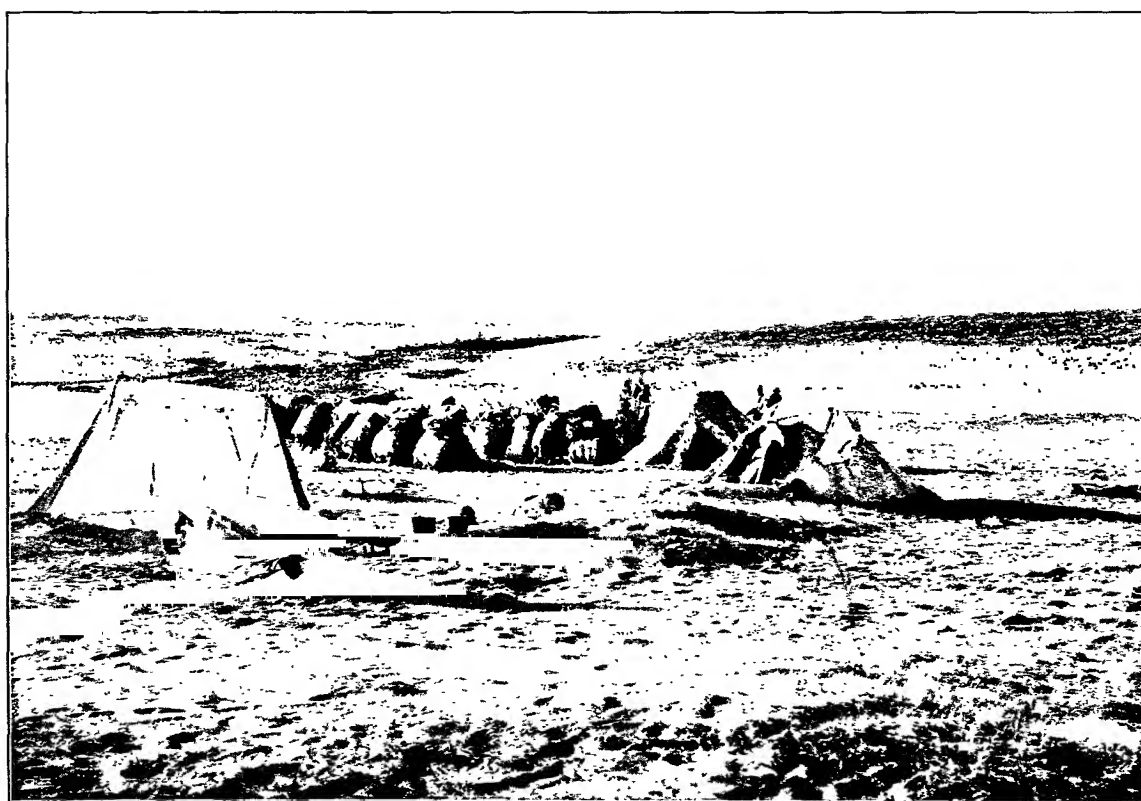


Fig. 340. CAMP XXII.

A characteristic feature of this region is the numerous tiny lakes or pools which lie scattered all over the irregular surface. They appear to be relatively deep, to judge from the dark shades of the water. In all those that we tested the water was perfectly fresh. Some were still frozen, while others had a soft, water-logged ice-sheet in the middle, and yet others again were perfectly free from ice; but none of these small sheets of water will be free from ice for more than three months in the year at the most. One, which we passed on our left, was a good deal bigger than the others. When seen from the top of a hill, the country looked chequered

like a chess-board in consequence of these tiny lakes, amongst which we wound in and out, carefully avoiding as far as possible everything in the nature of a pass.

At length our advance was barred by a range of moderate elevation with, to the north of it, a valley running west-north-west. Its bottom, which consisted of sand, although very wet, was nevertheless sufficiently firm to bear us. Here then was the place to turn off west so as, with the aid of our itinerary of the year before, to try and find the lake. A little way down the valley the grass was growing on the right side of its brook, and there we pitched Camp XXII at an altitude of 5069 m. Thus, although for the past two days we had been travelling away from the Arka-tagh, the absolute altitude decreased but little; we were still at an elevation of about

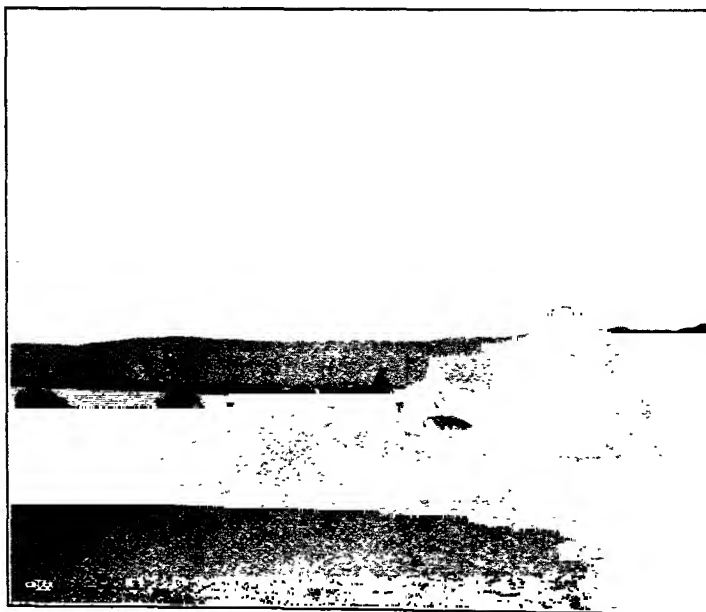


Fig. 341. VIEW FROM CAMP XXIII.

5000 m. The Arka-tagh seems to act merely as a dam or barrier against an ocean of disintegration products which lie heaped up on its southern flank. Hard rock was now a rarity. At one point near the large lake there was tuff, of a red colour, dipping  $60^{\circ}$  towards the N.  $70^{\circ}$  E.; but the dip is rather uncertain, for I was not able to decide whether it really belonged to a formation *in situ* or was merely the dip of a mechanical accumulation of fragments of rock. At Camp XXII the same rock dipped  $74^{\circ}$  towards the N.  $10^{\circ}$  W., and appeared to consist of beds of tuff overlying other species of rock. The vast number of fragments proves, that over large areas similar beds have crumbled to pieces and become converted into ruins. In this same region we also found thickly scattered over the ground quartz crystals and cairngorms, some with bright, glittering facets, others roughened and with rounded edges.

On the 25th June we had a monotonous march, as is usually the case in these everlastingly uniform, gloomy, lifeless, tedious latitudinal valleys, where even the track

of a wild animal is a rare and seldom sight. All day we did not see a single living creature, except a species of small Crustacean (*Gammarus pulex*) which exists in the freshwater pools and is described by Prof. Leche in the Zoological Section of this work. To come upon the footprint of an orongo antelope or the droppings of a kulan was almost an event for the caravan, though at the same time these discoveries inspired in us the faint hope of soon finding grazing of some sort.



Fig. 342. LOOKING EAST FROM CAMP XXIII.

The country was again favourable for travelling, and we kept on down the valley to the west-north-west. The ground was firm enough to bear us; such soft marshy tracts as did exist were easily avoided. A short distance after we forded the brook, it emptied itself into a large frozen freshwater pool, and around it were a great number of similar sheets of water filling every depression. Thus the big broad latitudinal valley which we were following does not possess any continuous drainage effluent, but is divided by low swellings into a series of separate basins. For the whole distance that we were able to see, this valley was bordered on the north by the main range of the Arka-tagh, while to the west-north-west we perceived the great mass that we had also seen from our camp beside the lake of the year before. On the south the same valley is bordered by a not particularly high range; this I preferred to make a circuit round, that we might not tax the strength of the caravan unnecessarily. Whilst marching along its northern foot we crossed over a number of



gullies, most of them then dry. These all make their way down to the series of tiny lakes or pools which we passed close on our right hand in the middle of the valley. Stretches of grass were quite common, though frequently interrupted by perfectly barren ground. Curiously enough, we failed to detect droppings of either wild yaks or kulans. This broken ground appeared to reach all the way to the foot of the Arka-tagh. The scenery still preserved the same monotony; hour after hour we tramped away westwards without any change taking place. Our view on ahead was unceasingly limited by fresh irregularities and fresh upswellings of the surface.

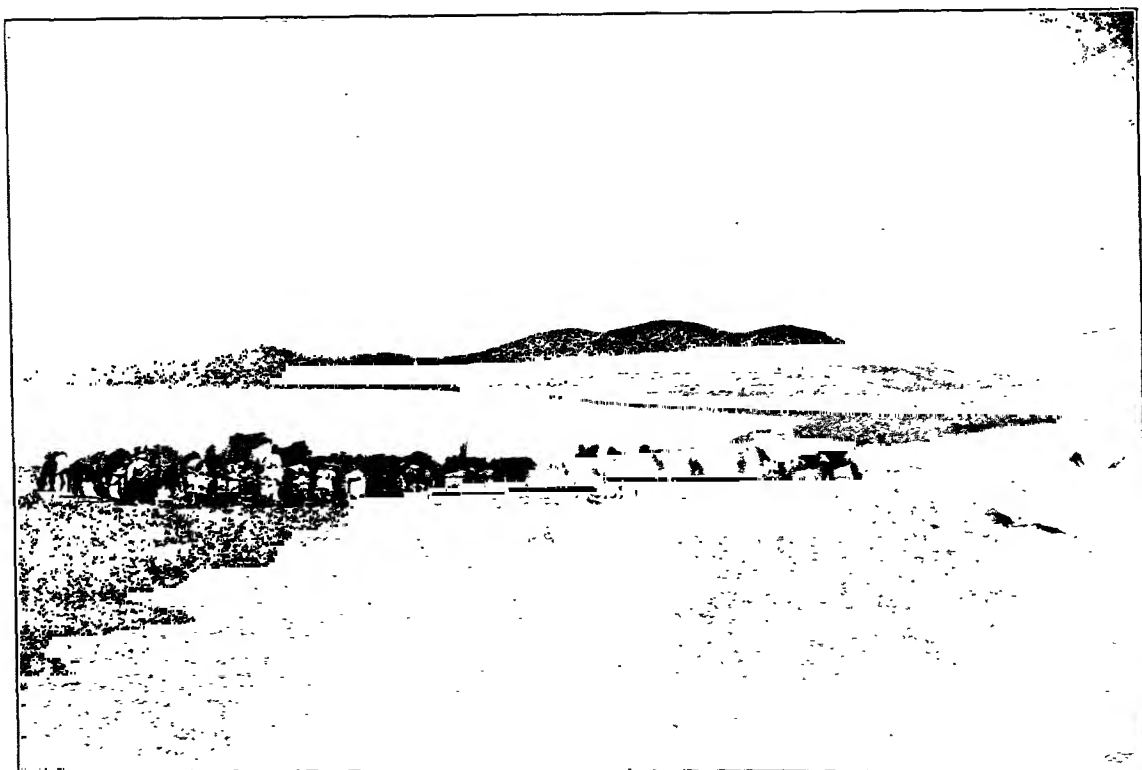


Fig. 343. VIEW LOOKING EAST FROM CAMP XXIII (CONTINUATION TO THE RIGHT OF FIG. 342).

The silhouettes of our advanced guard would be outlined on the top of the next hill, then down they would go on the other side, but soon would loom again on the summit of the next eminence beyond. An immense double peak, which lifted itself up to the N.  $87^{\circ}$  W. from a compact snowy mass of the Arka-tagh, stood out like a beacon at the distance of I dare say a hundred kilometers or so, but was nevertheless sharply and distinctly outlined in the clear, transparent atmosphere. We made Camp XXIII on the western shore of a large pool or small lake at an altitude of 5073 m., almost exactly the same elevation as the last camp before it. The lake was encircled by grassy hills; its ice-sheet was soft, and looked as if it would soon disappear, for there was a ring of open water all round the shores, which were of course a trifle warmer.

At 9 p.m. an extremely violent tempest burst out of the north-north-east; but though it covered the sky with clouds, no rain fell; the temperature however rose

to as much as  $8.9^{\circ}$ . But quite early the following morning we had again the usual hard and tiring west wind, though the sky was at the same time clear.

The stage that we covered on the 26th June, still west-south-west down the same latitudinal valley, which had an imperceptible slope in the same direction, was every bit as monotonous as its predecessor. All this time we had the range of the Arka-tagh on the north, and the smaller parallel range on the south. The latter increases in size towards the west and at the same time bends west-south-west; there was some snow lying on its northern flank. But this range soon turned out to be an old acquaintance of the year before; I recognised again the solitary pyramidal peak, by the eastern foot of which a year ago we had descended from the high Camp LX to the lake, and I also recognised again the sharp pyramidal peaks that rise to the west of it.

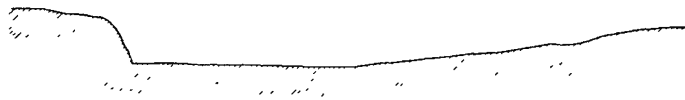


Fig. 344.

The going was however favourable, the surface being everywhere firm, except occasionally in the bed of this or the other watercourse. The country was less broken. There were indeed freshwater pools, but they were less numerous than before. Down some of the transverse glens in the southern range ran brooks of clear water in rather deep, but broad beds. In these the right terraced bank is usually steep, but the left has a gentle gradient (fig. 344). All the brooks that issue out of this southern range flow towards the north, either to unite with the larger river which comes from the east and disembogues in the large lake or else to empty themselves into the small lakes. These were in this quarter generally frozen over and always contained fresh water; probably they have some sort of underground connection with the large lake which lies at a lower level. When seen in profile, the flank of the southern range is generally stepped: on the top is the actual crest with its steeper declivity; then gentle hills, which end in a rather abrupt terrace, sometimes double; and at the bottom of all comes the valley itself, sloping slowly and evenly down to the centre of the depression (fig. 345).

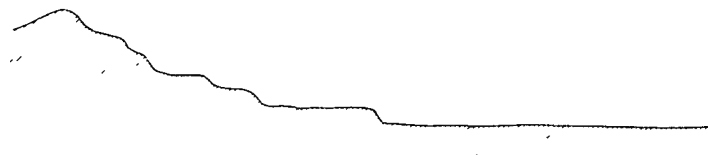


Fig. 345.

We now caught glimpses of the great lake to the north-west and west. Once we had left the last of the hills behind us, we found ourselves traversing the level grassy steppe that slopes imperceptibly down to the lake-side. We readily identified the spot where we had encamped (Camp LXI) the autumn before on the left bank of a brook; the ashes and camel-droppings were still there plain enough to see.

On the west side of the hills which stand immediately west of that Camp (Camp XXIV of this present journey) the grass was relatively good, so that I there gave the caravan a day's rest. On the opposite or right bank my Cossacks and the Lama built up an *obo* in the shape of two pointed pyramids (fig. 346), while the Mussulmans set up a smaller *nischan*. Hence it will be quite easy for the future traveller to recognise the spot.



Fig. 346. CAMP XXIV. VIEW TO THE S 25° E.

Faunal life was the reverse of plentiful; the only living creatures we saw were a couple of wild-geese, which came flying from the west, though next day they returned in the same direction. On both these days the temperature was unusually high, being not far short of  $20^{\circ}$  at noon. Nevertheless the wind continued to blow hard from the west, just as it had done when we visited this lake before. The wind drives in fact through these open latitudinal valleys with the regularity and force of a trade-wind; and, as the ground in this region was dry, the air was filled with whirling clouds of dust.

As for the lake, end of June though it was, it was still for the most part frozen, though the ice was rotten and soft, and looked as if it could not long resist the now rapidly rising summer temperature. In the beginning of July, or at all events during the first half of that month, the lake would be entirely free from ice; but it would hardly remain unfrozen for more than three months. On the 28th September we found the lake itself without a vestige of ice, though in a detached basin at its eastern extremity, into which a river discharges, there was a thin crust.

The lake freezes probably in the middle or end of October, unless the formation of the ice is delayed by continuous storms. The conditions under which the lakes of northern Tibet freeze must of course vary, being dependent upon several different factors, such as the absolute altitude, the more or less exposed position of the lake relative to the locality, and its accessibility to the prevailing winds, the area of the lake and its depth, and above all the varying degree of salinity. In a can of water taken out of this lake at a perfectly open spot the areometer gave a sp.gr. of 1.002

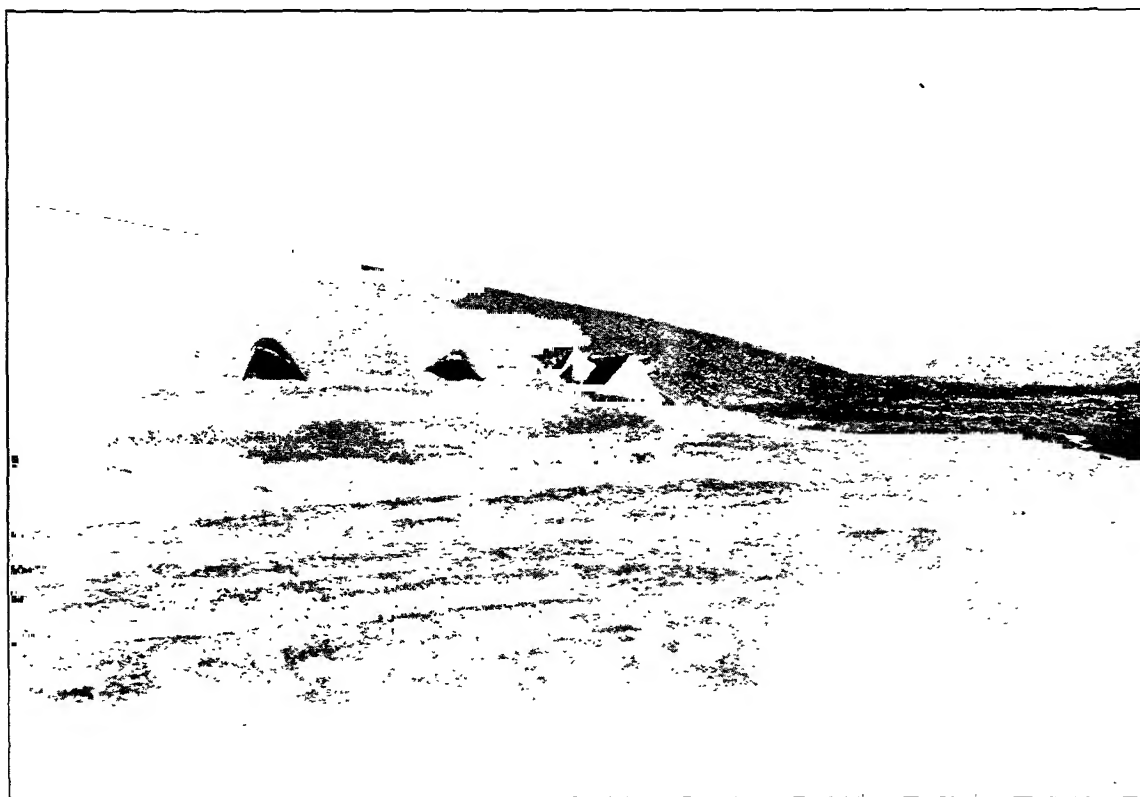


Fig. 347. S 30° W FROM CAMP XXIV. 1901.

when the temperature of the water was  $+5.2^{\circ}$ . Close to the edge of the ice the salinity was hardly noticeable to the taste; but this was no doubt because the ice was just then thawing. This lake lies 4948 m.\* above sea-level, and from the flat plateau-like country around it, I should suppose that it does not go down to any very great depth. I was unable to make any observations with the view of ascertaining the depth owing to the ice, and even though the lake had been free of ice, it would have been impossible to launch our skiff upon it, because of the gale. As the prevailing wind comes from the west, it may safely be assumed that the ice breaks up at that end first; then the wind eats away at the edge of the broken ice, which thus recedes farther and farther east.

When one travels through a country such as this is immediately south of the loftiest and most connected range (that is considering the crest) on the face of the

\* The altitude of Camp XXIV (= Camp LXXI, 1900), ought to be 4948, and not 4907 and 4990 resp. as in the meteorological part and on the map.

earth, and observes all these lakes, large and small, scattered over the face of the flat, broken, billowy surface, one is instinctively led to suppose, that they must have owed their primary origin to glaciation. But one looks in vain for traces of former glaciers in the glens and valleys of the Arka-tagh. It is impossible to discover even so much as an indication that this region has ever been covered with ice. Where the hard rock crops out it is weathered to such an extent that if glacial striations ever did exist, they have been completely obliterated. Moreover the range consists, as we have seen, of extremely finely sifted disintegration material. It is equally vain to search for erratic blocks as for moraines on either the north or the south of the Arka-tagh. At the first glance one may indeed be tempted to take a stretch of hills for an old moraine, greatly flattened and levelled down; but their structure, where it is indeed sufficiently exposed to be observable, soon banishes the idea, for it is in no respect like the structure of the ordinary moraines. So far as I was able to judge, these hills consist exclusively of sand and dust, and support smaller fragments and chips of tuff scattered over their surface (fig. 348).



Fig. 348.

Still all this does not prove that this region never was covered with ice. In those parts of the Arka-tagh which lie farther west, and which I passed in 1896, I did discover some glacier arms, very short it is true, but still possibly forming the last lingering survivals of former extensive ice-fields. Both the shape and the relief of the Arka-tagh bear witness to a powerful denudation and levelling down, the process having now reached a very advanced stage. The enormous differences between day and night and between winter and summer, the active insolation, the rupturing effects of frost, all contribute to the disintegration of these mountains; and as the traces of older glaciation are rather superficial, it is not surprising that they should be obliterated in a country which is so greatly exposed to the denuding agencies of nature as this is. It may be that such an immense period of time has elapsed since the Arka-tagh was under ice — supposing it was indeed glaciated — that even erratic blocks of considerable size have become entirely pulverised. The part which the prevailing winds play in this work of destruction is, as I have already mentioned, not particularly great, and the wind blows *per se* with unexampled violence throughout the whole of the Tibetan highlands. Its effects are however counteracted during the »warm» season by the precipitation, which makes the ground almost everywhere moist, so that the finer materials of which it consists are bound and held together. During the winter half of the year the same ground is frozen, a condition in which it is equally fitted to oppose the action not only of corrasion but also of deflation. Did the wind possess a more incisive power of transportation and sedimentation, drift-sand areas would be met with in Tibet, at all events here and there; but as a matter of fact the sandy area south of the Upper Kum-köl is the only one possessing any degree of either importance or extent. When in certain parts of the

open latitudinal valleys the rain and snow fail to fall for some days, then the wind does, it is true, obtain an opportunity to sweep the powdery material away off the ground; but as this falls soon afterwards in some moist place, it does not amount to more than a local transportation of no great moment — it is in fact one of the factors which help to fill up the self-contained basins and render them flatter and flatter.

June 28th. Upon leaving Camp XXIV we directed our march towards the south-west, leaving on the right the small hills which have four pools at their southern foot. On the left we had the ridge or slopes of the foothills that belong to the range which we had crossed over a year ago. It was my intention to keep to the west of the meridional route of the year before, for the latter had taken us through such an unfavourable country. After a while we reached the lake-shore, and in its strip of hard gravel-strewn strand had the most excellent track for marching on. Here too there were several small lagoons, entirely cut off from the lake. But we soon left the lake side and proceeded to ascend the slope of the flat ridge that rises to the south, obtaining from it, as soon as we got high enough, a splendid view of the western blunted end of the lake. The ice glittered white as snow in the sunshine, but striped here and there by bands of sky-blue open water. There are hills and ridges too on its western shore; nor are lagoons wanting either.

We made our way up to the pass (alt. 5080 m.) in the little ridge by means of a short, but rather steep, glen with a moist bottom, and with small sand-dunes on both sides. The descent south-westwards from the rounded pass is very gentle, in consequence of the dip which the rocks make towards the south. The country hereabouts was broken, the eroded watercourses making their way southwards by shallow glens amongst the ridges into small pools. Then the next lake came into sight; it was round in shape and rather small. We followed its eastern shore towards the south-south-east, the gravel there being beaten hard. The whole of the lake was sheeted with ice, soft and white as snow, and without an opening in it, though here and there it had long cracks across it. The ice-sheet, having begun to break away from the sides, had been driven by the wind towards the eastern end of the lake, the pressure of the ice building up a ridge one or two feet high; but the ridge was so soft and lay so near to the surface of the water that it would assuredly be destroyed by the waves when the tempests began to blow. Here too there were pools and lagoons close to the lake-side, with a number of wild-geese in them. Camp XXV will be found at the south-east corner of the lake, at an altitude of 4980 m. Consequently this lake lies rather higher than the last one, and as its water was virtually fresh to the palate, one is naturally inclined to suppose that it has some subterranean effluent. Nevertheless a closer examination showed that the thawing of the ice then in progress was deceptive, for upon our obtaining a specimen of the water out of the only bay there was, the areometer gave a sp.gr. of 1.0033 at a temperature of 3.8°. In the summer, when all the ice has melted and the water is more thoroughly intermingled, and when the evaporation from the surface becomes increasingly greater, the salinity will pretty certainly be progressively greater too. Close to our camp two shallow bays were formed by a peninsula and a low-lying island. The only open water was in these two bays, some ice-sheets

having got aground there. The grazing along the shore was relatively good, and the kulans were clearly aware of the fact. The mountains to the south did not look particularly dangerous; but it is easy to deceive oneself in this respect, for difficult mountains often lie hidden behind the nearest hills. All this time we had in view to the west-north-west the immense double peak of the-Ullugh-Mus-tagh.



Fig. 349. OPEN LANDSCAPE OF THE NORTH TIBETAN PLATEAU.

On the ridge between the two lakes, the highest summits of which we had evaded by making a detour to the west, I took two specimens of the sandstone schists prevalent in the neighbourhood. One of these dipped  $40^{\circ}$  towards the S.  $40^{\circ}$  W., the other  $45^{\circ}$  towards the N.  $5^{\circ}$  E. It is very seldom that the rocks are so intact that their bedding is distinct or may be implicitly relied upon. Usually the beds dip towards the south, so that the sharp-edged ridges with the outcrops point towards the north. From this rule, if rule it can be called, there are however numerous exceptions. In one or two places I observed the veins of quartzite projecting through the disintegrated *débris* (which consists of the same sandstone), partly as small chips and laminæ, partly as finely pulverised dust. In colour it is red or green, and exhibits several varieties of shade, the differences being apparently dependent upon the angle of inclination and the dip in relation to the sun. In the vicinity of Camp XXIV I observed the occurrence of a peculiar kind of spherical stones, concentric integuments arranged round a central nucleus, which put me in mind of the volcanic *lapilli*. Most of them were however defective, only one-half, or even a smaller portion, remaining.

On the morning of the 29th June the sky was perfectly clear and serene. There was not the slightest speck of cloud around the double peak of the Ullugh-Mus-tagh; and its white summit, together with the entire mass of which the double

peak is the culminating feature, stood out with wonderful clearness, brilliantly white against the light blue background. And the weather continued to be fine; although the day did not pass without the usual regular wind, blowing however from the south-west and west-south-west. When we reached the highest pass a little snow fell. The faunal life here embraced kulans and orongo antelopes, wolves, partridges, and the species of gull known to the Turks as *hangeit*; but over on the south side of the range which we were about to cross animal life was well represented.



Fig. 350. OPEN LANDSCAPE OF THE NORTH TIBETAN PLATEAU.

At Camp XXV the southern shore of the round lake turned rather abruptly towards the west. We struck away from the lake in a south-west direction, leaving behind us a small lagoon entered by a main watercourse with a moist bottom. This latter picks up several other waterless torrents, all coming from the south-east. The ground was greatly broken, and the ascent towards the culminating crest of the range quite noticeable from the beginning. The slopes consisted entirely of soft disintegration material, and were rounded. Up these we mounted until we reached a large glen, which likewise makes its way down to the recently mentioned lagoon. By means of its upper part we climbed up to the very flat pass, the summit of which forms quite a platform at an altitude of 5116 m. From it we enjoyed the most magnificent view southwards across the immense *kakir*, or latitudinal valley; but as for its real course and true appearance, it was at that great distance impossible to judge, because of the great number of watercourses, hills, and mountain spurs which convert it into a veritable labyrinth. Here too the relief was deceptive: in one place there was a watercourse which appeared to offer the nearest and easiest path down to the shore of a moderate-sized lake and in the other direction several smaller lakes; but when we subsequently descended from the summit of the range



and got entangled amongst the diversities of its southern slopes, the prospect became restricted and shut in, and we no longer knew where we were. The next east-west range lies a long way to the south. We recognised again the characteristic morphology which we had studied on our previous summer's excursion, and which may be briefly defined thus: the traveller who proceeds across the highlands of Tibet in a meridional direction has to cross over a whole series of mountain-ranges running east and west. Yet though it is thus a vast deal easier to travel through the country in a direction parallel to its mountain-ranges, that is to say, along one of the great latitudinal valleys; on the other hand it is immensely more instructive to cross over them all at right angles. And in this particular part of Tibet we have, as it happens, several such meridional routes, namely those of Bonvalot, Littledale, Dutreuil de Rhins, and my own three; and from this material, as soon as it has all been incorporated on the map, I shall be able to deduce what are the great determinative features of the geography of northern and eastern Tibet. Rockhill's and Carey's itineraries make an excellent supplement to the map, while my own journey in 1896 and Wellby's will show clearly and distinctly the entire course of two of the great latitudinal valleys. It is very interesting to possess detailed maps of these two great valleys, for in the light of what they teach us we may say pretty certainly, that the other latitudinal valleys, at all events those which are situated immediately to the south, will be fairly like them.

From the top of the range on which we were then standing three peaks in particular attracted our attention, namely those which I have designated Y, Z, and A, situated respectively S.  $64^{\circ}$  E., S.  $40^{\circ}$  E., S.  $2^{\circ}$  W.

It is with a feeling of satisfaction that you begin the descent from a range such as this. Your caravan marches easily and without exertion. Nevertheless it is not an unmixed satisfaction you feel, for before you lie, not one range, but several ranges similar to the one you see; and each in turn tries still more the strength of your animals. The southern slopes are in places rather grassy, but on the whole barren gravel covers the larger area; on the north side the slopes are perfectly barren. We soon crossed over a flat secondary pass (5008 m.), and found ourselves in a descending glen; but as this manifested an increasingly stronger tendency to bend away to the south-east, that is towards the tiresome and abominable country that we had travelled across before, we climbed up out of it towards a third, and rather difficult, pass (5013 m.) on the right. Near it were two slightly saline springs in a barren country. The water in two or three of the adjacent watercourses was intensely salt. When travelling in these desolate and inhospitable wilds, no sooner have you covered a fair average day's march than you begin to wonder where you are going to find a suitable camping-ground, with drinkable water and a supply of grazing, together with fuel, which always consists of wild yak dung or the hard dry scrub known as *jer-baghri* or *japkak*. As not one of these requisites was discoverable on these particular slopes, we had no alternative but to push on farther. Accordingly we now descended over the barren and desolate slopes and dry glens until we reached the moderate-sized lake down in the latitudinal valley. But even from a distance it was pretty easy to guess that this lake was very salt, because not only was there a chain of hills of a fiery red colour descending pretty steeply towards it, but there

was not a scrap of ice visible anywhere on its surface. And it proved to be as we suspected — intensely salt. The west part of the lake is rather irregular in outline, what with peninsulas and a couple of low sedimentary islands. But a little distance back from the water there was some grass as well as japkak. Drinking water we obtained from what was for that part of the world an unusually large river, which forms a small delta on the south where it enters the lake. This lake, like nearly all others in these latitudinal valleys, is elongated from east to west. The areometer gave a reading of 1.031 at a temperature of  $9.2^{\circ}$  for the water.



Fig. 351. A GLEN IN NORTH TIBET.

This day the same schists prevailed as hitherto, generally with a dip towards the south and south-west. Besides these, we also found near the highest pass a hard porphyry-like species of rock, of a green colour and with a dip of  $62^{\circ}$  towards the S.  $25^{\circ}$  W.; while on the southern side of the same pass was a similar rock dipping  $57^{\circ}$  towards the S.  $39^{\circ}$  W. Still farther on came an extremely fine-grained rock, like diabase, of a pitch-black colour and dipping  $62^{\circ}$  towards the S.  $40^{\circ}$  W. In this range the hard rock cropped out more frequently than usual from the otherwise soft disintegrated materials of the hills. This material consisted almost exclusively of flakes of red and green sandstone; in fact, the highest pass was thickly strewn with them. Very occasionally I observed a quartz crystal lying on the surface of the ground. Where the hard rock does become visible, it is generally on the brae-sides, on the ridges, and at the low passes. The entire face of the country is uniformly flattened down and smoothed out; one looks everywhere in vain for sharp-pointed projections or rugged peaks or eminences. As my data show, the relative differences of altitude are very slight. Our camp this day stood at an altitude of 4946 m., consequently only 170 m. lower than the highest pass which we had crossed

over in this neighbourhood. And yet this particular point was lower than usual for that part of Tibet, and several days elapsed before we reached a place that was situated at the same relatively low altitude. As a general rule, even at our camping-sites, which we almost always selected in the bottoms of the valleys, we were more than 5000 m. above the level of the sea.

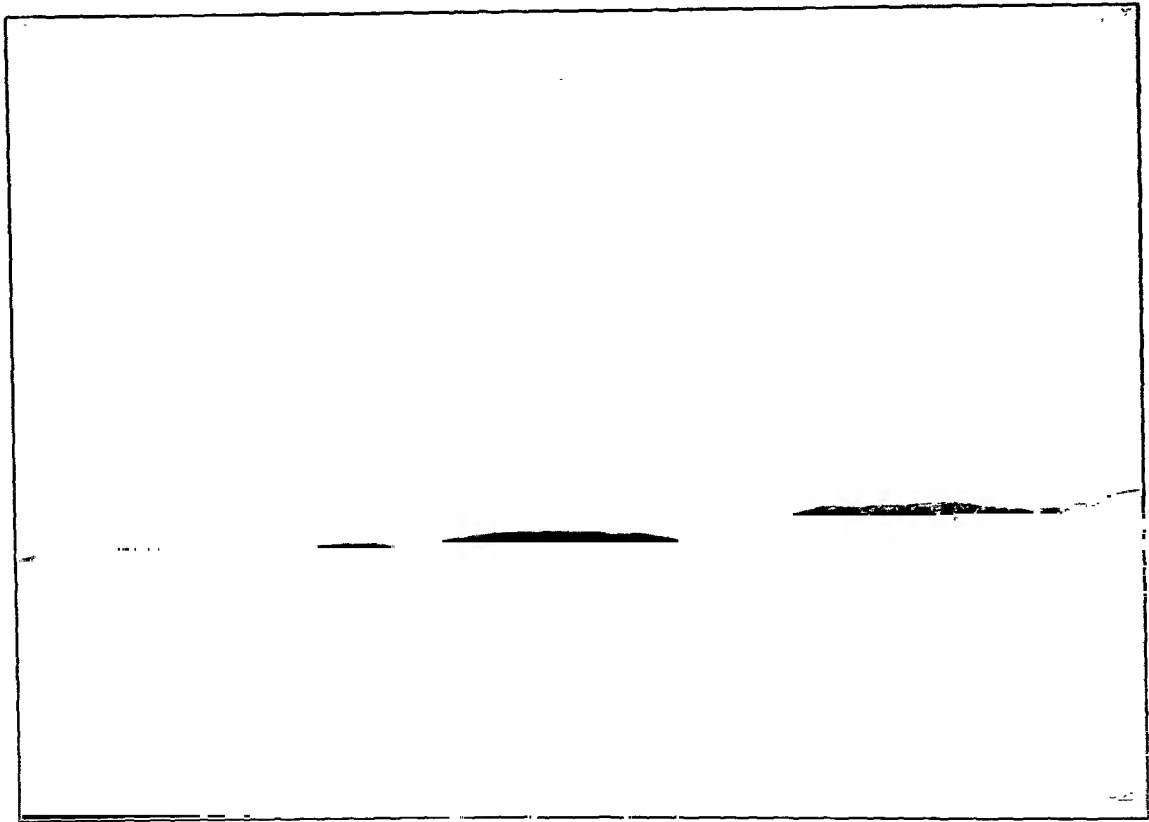


Fig. 352. VIEW LOOKING S FROM CAMP XXVII.

A curious change took place in the direction of the wind that afternoon. Earlier in the day we had the usual westerly wind (south-west and west-south-west), but at sunset it fell a dead calm. This did not however last long, for at 8 o'clock a furious tempest burst upon us from the north-north-east, the wind blowing with a velocity of  $16\frac{1}{2}$  m. in the second. Vast clouds of dust were whirled along just above the ground, though the sky above-head was perfectly clear, and the moon and stars glittered with indescribable brilliancy, as they usually do at night in Tibet. I may however say that, as a rule, the nights were calm, while the days were nearly always blowy, not to say tempestuous. This north-north-east tempest subsided in the early hours of the morning, and when the next day dawned the weather was glorious. But we had not been long started when the regular trade-wind, as I like to call it, set in again. Then too it came from a more southerly direction, sometimes indeed from the south-south-west.

Without any excessive degree of exertion we succeeded on the 30th June in crossing over the nearest heights. After having forded the river, which comes from

the south-west, and had then a volume of fully 2 cub.m. of clear water we climbed over two ridges, of which the more northerly one sends out a tongue into the lake, and so reached a small secondary pass (5002 m.). We still continued to have the Ullugh-Mus-tagh in sight to the N.  $54^{\circ}$  W.; it did not appear to be exceeded in altitude by any other peak then visible. At a considerable distance to the east we saw yet another lake; but it was frozen over, so that its water was no doubt fresh, or at all events only slightly salt.

From the little pass we made our way down to an especially deeply excavated glen, with a brook flowing along it, and shut in by steep, scarped terraces, consisting for the most part of gypsum, partly as crystals, partly as white powder. Otherwise the predominant tint was red. The grass was wretched, and continued to decrease in quantity. Thus we had three parallel ridges between this glen and the last one. The former glen, which is by far the larger of the two, comes from the south-west or west-south-west and terminates at the lake in the direction N.  $30^{\circ}$  E. The second and smaller glen comes from the S.  $70^{\circ}$  W., and proceeds towards the N.  $78^{\circ}$  E., and likewise terminates at the lake, in what is apparently a broad, round-ended bay projecting southwards.

From the next secondary pass we perceived in the west-south-west two small lakes or large pools, one frozen, the other with open water, an indication that the former drains into the latter, so that this forms presumably the lowest depression in the self-contained drainage-basin. Then, after crossing over yet another secondary pass, situated in a minor chain, we at length reached the highest pass in this mountain-system, which, fairly low though it was, was nevertheless broken and wearying. Its altitude is 5125 m., consequently a little higher than the highest pass of the day before. It is situated in a soft, flat chain, strewn with gravel and chips of the usual sandstone. Except for a little moss, it is quite barren. On both sides of the pass there are some quite small self-contained drainage-basins, though in only one of them was there any water, namely a small pool. From the summit of the pass we again saw the Ullugh-Mus-tagh to the N.  $49^{\circ}$  W.

The surface descends pretty steeply towards a river flowing towards the north-west. This stream had about the same dimensions as the river at Camp XXVI, and its water was equally clear; hence it is extremely probable, that they are one and the same. This is also conceivable because of its situation and of its relation to the lake. Thus it only describes a bend towards the west before emptying itself into the last-named, though in doing so it has to cut a passage through all the ridges and crests which we had climbed over by several tiring passes during the course of the day, and climbed over unnecessarily; for if we had only followed the river upwards from Camp XXVI we might have avoided them all. The upper part of the glen appeared to descend from the south and south-south-east, and if we had only travelled up it, partly in the bed of the stream, partly on the scantily grassed slopes at the side, we should have won a passage over the next main range. Upon coming to a spot where the grass gave signs of dying out, though there was still a little japkak, we made Camp XXVII, on the left side of the glen, at an altitude of 5070 m. Animal life was represented by orongo antelopes and partridges.

This day too hard rock was remarkably rare, despite the fact that we had crossed over a not inconsiderable mountain-system. But then it is composed almost entirely of disintegrated material, the ruins of a former mountain-range, which, as time goes on, is more and more approaching the state of complete dissolution and destruction. Its flat summit is already everywhere exposed to the attacks of erosion; its slopes are scored in every direction by gullies, like new ulcers and gaping sores. It was for this reason that we found it culminating, not in a crest, but in an entire system of parallel ridges. And every one of them now falls so much more easily a prey to the transporting power of the water in that erosion attacks them from all sides and is eating its way in deeper and deeper. Precipitation, frost, wind, and flowing water, all cooperate to wear down the heights more and more, paring off one layer after another from the surface and subsequently depositing the loose material in the bottoms of the glens on both sides of the range. And in this way the powers of denudation and down-levelling have been operative for thousands upon thousands of years. At the present period the Tibetan plateau presents a picture of inconceivable flatness — a rolling highland region, with long, sweeping undulations. Upon it is accumulated the material which has been brought down from the ancient mountain-ranges, and it is upon this alone that the power of erosion works its will. With regard to the hard rock, we have seen that the work of destruction is for the most part already completed. All that now uplifts itself above the ruins is an occasional bare crest. In the peripheral regions of the plateau bare rock plays on the contrary the predominant rôle; while farther south, in the central parts of the highlands, we shall frequently come into contact with backbones of hard rock. Hence it would be untrue to say, that the gigantic hollow which stretches between the Kwen-lun and the Himalaya is everywhere uniformly filled with disintegration products, for the statement is only correct of the northern half of Tibet, and more particularly of the broad zone south of the Arka-tagh. The equally broad zone which lies along the northern foot of the Himalaya is in a high degree unlike the northern zone. For one thing, its altitude above sea-level is considerably less; then it drains to the ocean, and is richly clothed with grass and steppe vegetation. In vol. IV we shall find ourselves in the northern part of this latter zone, that is to say in Central Tibet.

During this stage the only rock that I observed was gypsum, cropping out of the eroded terraces in light-coloured slabs and flakes in a single small glen. In this same glen, which ends at the salt lake, there was dark-grey schist and sandstone dipping  $73^{\circ}$  towards the N.  $30^{\circ}$  E.; all the gravel that we met with during the day consisted of the same formation, though this was the only place where it showed as solid rock.

## CHAPTER XXVII.

### FIRST STAGES ACROSS THE TIBETAN PLATEAU.

On the 1st July we had to climb more or less at right angles over the next east-west range, which towered up south of Camp XXVII in the form of a remarkably vast swelling, capped with perpetual snow. This we should have to get round either on the east or on the west, and as in both directions alike the range appeared to run at pretty much the same relative altitude, I deemed it advisable to send scouts to find out what the promise of the country might be. These men reported, that west of the great snowy mass it was practically impassable for camels, for not only were there three passes to be climbed over instead of one, but the ground was so soft that it would hardly bear the weight of a camel. On the other hand we might cross over on the east without any exceptional difficulty. That we should have to ascend to a considerable altitude was however pretty clear, for Camp XXVII itself stood at an elevation of 5070 m., and we had a good climb up from it.

The bottom of the glen offering the best track, with its bed of fine, compact gravel, up went the caravan, advancing at a slow pace. The scarped terraces beside the glen, though distinctly enough marked, were not especially high. Every now and again we crossed over the adjacent gently diversified slopes. By this the grass had come entirely to an end, even the moss had given out, and the country was absolutely barren; we had ascended above even the hardiest and most tenacious species of the Alpine vegetation. Except for one solitary hare, we did not see a vestige of life; while even traces of animals were extremely few and far between. Thus early in the morning the amount of water in the glen was quite insignificant, though perfectly clear. But when we reached the spot where the actual ascent up to the summit of the pass began, the brook had already swollen to quite a respectable stream; it was of a reddish brown colour, and frothed slightly as it made its way down its stony channel. But this, which was thaw-water, did not get down to Camp XXVII until the afternoon, as we had observed on the previous day; and possibly it needs twenty-four hours, or rather less, in order to reach the salt lake at Camp XXVI. In this way the amount of water in the river-bed varies during the course of the twenty-four hours, as also during the course of the short

summer; in winter no thaw-water will presumably descend from this snow-field, though possibly there may be springs at intervals in the bed. The similar glen which begins west of the snowy mass, and contrary to expectation flows at first towards the north-east, does not join the glen which we were then following, at all events not along the stretch that we traversed. Instead of doing so, it curves away towards the northwest; possibly both glens unite lower down. At this time there was not a drop of water in the western glen.

On a clear bright day such as that was this eastern river receives in its upper part a large number of brooks and rivulets, most of which flow down from the tongues and arms that jut out from the snow-field. The principal river was however very muddy, and was stained red by the soft formations higher up. The lower parts of the snow-field, especially where directly exposed to the sun, were softened, slushy, and water-logged; but during the night they freeze again and consequently shrink, as also does the principal river during the early hours of the morning. Having attained its maximum volume, the river dwindled again according as we passed one contributory brook after another. From the right it does not pick up a single tributary. Its bottom is firm and hard, consisting of gravel, both fine and of medium size. Thanks to the excellent firmness of the ground, and the uniform and not especially steep character of the slope, our caravan animals, tired though they were, succeeded in getting over this pass, one of the highest I have ever surmounted. Its altitude reached 5337 m. In shape the pass is rounded, with gently curved contours, being situated amongst finely powdered, disintegrated material. The previous summer we had crossed over this same range by a considerably lower pass farther to the east.

The glen that descends on the other side proceeds first towards the east and east-south-east, but soon turns to the south-east; and as we went down it, we still had for a time an offshoot of the culminating mass immediately on our right. In other words the pass is excentrically situated in relation to the summit and lies north of the eastern end of the great snowy mass. In consequence of this the view that one would expect to have to the south from such a lofty vantage-point is obstructed. In every direction there was nothing to be seen except rounded heights of a brick-red colour. One of my Cossacks, who climbed to the top of an adjacent peak, reported that he was able to see three or four lakes of different sizes to the south and south-east.

Only a very short distance below the summit of the pass we found water flowing down the glen that runs south-east, but the first contributories from the snow-field were larger than the principal artery itself. In this way the river soon grows to a not inconsiderable stream, though its channel is very unlike that on the north side of the pass, for it is narrow and difficult, being choked with coarse detritus and small stones. Besides which we had to keep crossing over the stream every minute, and as it continued to grow bigger and bigger this became at last very irksome. But all at once the glen expanded, and we were able to leave the river on our left and yet ride down the dry parts of its bed. A little lower down we pitched Camp XXVIII on the well-defined hilly right bank, at a point where the river makes a bend to the east-south-east. To the south-east we saw a small lake,

the yellow shores of which appeared to point to the presence of grass. In the same direction the peak Å was visible, with several other conspicuous peaks around it.

Our new camp was situated at an altitude of 5213 m., or only 124 m. lower than the pass which we had just crossed over. On the southern face of the culminating mass the snow had almost entirely disappeared; the greater part of this snow-field lies on the north side of the crest, where the sun has less power. At this pass I estimated that the snow-line runs at 5450 m.; but on the southern versant of the range it will lie about 100 m. higher. In this part of Tibet the snow-line will of course vary considerably according to the local circumstances. The great snowy mass under consideration is isolated, and consequently in a high degree exposed to the wind and to insolation. When in a greater and more continuous mass the snow possesses an enhanced power of resistance; and when a range is concave towards the north the snow-line lies lower than when it is convex in the same direction.

During the last few stages the weather had been exceptionally favourable. True, the westerly or south-westerly wind blew as usual, but it was warm. Summer was just beginning to visit these regions, though at the same time we were also approaching warmer districts. For two days past we had neither snow nor hail. It is to this that the rapid thawing of the snow on the great mountain-mass was attributable. When the sky is clouded and the wind blows hard, with hail and snow, the rate of thawing is of course greatly retarded. It must not therefore be supposed, that in July and August, the two true summer months, the snow-field becomes so seriously diminished as to push back the limit of the snow-line above the altitude I have given. For during those two months also there are frequent showers of snow or hail, this being the form that the precipitation always assumes in these high altitudes, at all events it does so upon this great snowy mass. The snow-cap, which covered the summit of the mass on 1st July, never disappears; its lower margin also moves up and down in an oscillating sort of way. After a spell of bright, warm weather it moves higher up; but no sooner does the sky cloud over, and the down-fall begin again, than it descends lower.

I have already stated, that hard rocks are in general very rare in this part of Tibet. It is indeed only what might naturally be expected, when the highlands are looked at as a whole, that the hard rock should crop out more generally in those districts which form relative swellings and where the mountainous backbones have resisted denudation down to our own time, rather than in the relatively low regions, that is to say, the flat, hollow depressions which are already in great part filled up with crumbling disintegrated material. And during the course of the stage last described we had opportunity to observe the truth of this, for the hard rock showed itself much more frequently than during the preceding stages. In the meridional glen I observed successively the following rocks — a dark-blue, close-grained schist dipping  $57^{\circ}$  towards the S.  $30^{\circ}$  E.; then crystallised gypsum in big pieces or knobs on the terraced escarpment; then an extremely hard black rock, traversed in every direction by white mineral veins; further a fine black schist dipping  $65^{\circ}$  towards the N.  $10^{\circ}$  W., and split into a great number of small thin, fine flakes and sheets. Moreover there was conglomerate, and finally gypsum again. Dark schists cropped out everywhere at the bends where the erosion has been most energetic. On the whole



the predominating tint of the scenery is a fiery red, especially south of the pass. It is very probable that this range is identical with that which Grenard calls *Montagnes Rouges du Sud*, a name that is fully justified when applied to a range so strongly coloured as this is; besides, it is of great service as a guide to other travellers. The red matter, which is no doubt derived from red sandstone and clay-slates, is extremely finely sifted, as fine in fact as the »dustiest» powder. It was a good thing for us that it was dry; had it been moist, the country would have been almost impassable. On the southern side of the pass the fiery red sandstone and hard fine-grained conglomerate crop out and show a distinct bedding, though they alternate with black schists. Very often snowy white gypsum peeps up through the red disintegrated material, with or without crystals, though generally it stands out in the form of big knobs and bosses, more or less dissected out as it were.

July 2nd. Instead of following towards the east-south-east the river which flowed past our camp, and which would have brought us too near to our route of the year before, we turned off towards the south-west, and crossed over broken country with an exceedingly gentle upward slope. The view southwards was impeded by a minor range stretching from north-east to south-west. Between this range and our route were a series of pools of moderate size. The first, which lay immediately south of Camp XXVIII, is the largest, and is entered by a little brook that originates on the southern side of the great snowy mass. After crossing over a flat, unnoticeable water-divide, we approached the little range on our left. The ground there slopes to the south-west, towards a little round lake, in which some ice still survived in a westerly and relatively more sheltered bay. The water was perfectly fresh and clear. At our approach five wild-geese swam out from the eastern shore. The altitude was 5172 m. above sea-level. Although the grazing was wretched to a degree, we saw some orongo antelopes. South of the lake there are again two pools; but after that the country once more ascends gently towards the south-west in a broad glen, shut in on the north by a small crest. On the north too the great snowy mass towers up above the range which we had crossed over the day before. Immediately south of it, and quite close to the main range, there is another parallel range, with three dominating dome-shaped eminences, of a brick-red colour and free from snow; this is cleft by a couple of deeply cut glens, through which the thaw-water flows down off the snow-cap of the great mountain-mass. Thus the range is here double, unless indeed the southern range ought not rather to be considered as entirely secondary to the main range.

It turned out that we might have chosen a far easier route from the heights above down to the middle of the next latitudinal valley, had we only struck south from Camp XXVIII, and then gone south-west. Instead of that, we were now travelling south-west, and after that went south-south-east; this brought us however into more unfavourable country. The range which obstructed our passage southwards was much too steep for the camels, and they had to be led a considerable way round. I myself climbed over the top; but the southern slope was extraordinarily steep, and thickly strewn with detritus and flakes of red sandstone. In a glen at its southern foot we again found a little grazing, while on its right-hand (i. e. western) terraced bank we discovered some rudimentary dunes. This side-glen

debouches upon a large brook, which descends from the great snowy mass on the north, and has scooped out for itself a deep and distinct bed towards the south-south-east. The water was clear and excellent to the taste. Owing to the rough and hilly character of its side-slopes, we were obliged to march in the bottom of the glen, which grew increasingly deeper and narrower as we descended it. The bed is quite filled with chips and débris of the red sandstone, making it slow work to march; we had to cross over the brook times without number. In some places on the right side of the glen there were narrow stretches of sand-dunes. At length the brook was prevented from continuing farther south-south-east by a minor range; being unable to break through this, it turns at right angles towards the east-north-



Fig. 353. THE GLEN FILLED WITH SANDSTONE DÉBRIS.

east, and soon afterwards disappears amongst the hills. It is pretty safe to say, that it terminates in some salt lake in that direction. Leaving this stream on the left, we crossed over the obstructing ridge by a little flat pass, on the north side of which was a small pool. We made Camp XXIX at the eastern corner of a little lake, down to which a broad glen leads from the north, the altitude being 4959 m. The water was drinkable, although it had a distinctly saline flavour. The areometer gave a sp. gr. of 1.004 at a temperature of 9.1°. One would have expected to find that this little lake, confined as it is to such a distinctly self-contained basin, would be intensely salt; but probably it possesses an invisible outlet at some level through the layer of sand, by which the salt water occasionally makes its escape. Both the configuration of the ground and the presence of older shore-lines reveal that the level varies as much as a couple of meters. Possibly it was just then at its minimum, and during the summer would rise, for I have no doubt the western part of the lake is entered by some stream or other coming down off the snow-fields to the north. At that time it was not entered by even the very tiniest brook, so that possibly it

is fed entirely by springs that gush up at the bottom. It was plain that the lake would rise still higher, and then no doubt its water would overflow at some low point or other. The northern shore is remarkably flat and quite barren; the lake is shallow, whereas on the southern side it descends more steeply. On this latter side, where the surface consisted of fine dust and sand, then bone-dry, there was a richer supply of grass than we met with for some considerable time afterwards; this was in part due to the soil and the relatively lower elevation — although this was still quite respectable, seeing that we were some 150 m. above the top of Mt. Blanc — but it was in particular attributable to the fact that this was the first fresh, soft, sappy grass we had encountered on the highlands: it was not dry and yellow as it had hitherto been, but was green and nourishing. Still it was thin, as it is everywhere on the highlands, so much so that when seen at a distance it seems scarce able to impart a green colour to the ground.

At a considerable distance to the east-south-east we perceived a great snowy mountain; this I took to be the summits which on my previous journey I designated with the letters  $M_iN_i$ . Hence the chain, which bounds on the south the latitudinal valley in which our camp beside the lake was situated, must form a direct westward continuation of the summits  $M_iN_i$ . A good 30 km. farther east of Camp XXIX our Camp LVI of the former journey ought therefore to be found, the camp namely at which one of my men was buried.

Not far from the first round lake of this day we came upon red sandstone, dipping  $25^\circ$  towards the S.  $56^\circ$  E., and close to the point at which the descending brook turns towards the east a beautiful variety of the same rock, but striped black and grey, and dipping  $30^\circ$  towards the S.  $20^\circ$  E. This same sandstone prevailed all day, and indeed it has set its impress upon the face of the country, which is everywhere some shade or other of red — brick-red, blood-red, yellowish red, dark red. From the same rock is derived the abundant detritus that fills the bottom of the same glen. Some of the larger slabs, particularly regular in shape, and with perfectly parallel surfaces, might advantageously be used for table-tops.

On the strength of several days' observations in this region, I concluded that the following data are characteristic of the wind relations there. The westerly »trade-wind« that blows regularly during the day appears to die away at sunset, and at dusk it is so calm that a candle burning unscreened in the open tent did not even flicker. This evening there crept over the scene a wonderfully thin and evanescent veil of mist, slightly obscuring and dimming the splendour of the moon. But at 8.10 p.m. a sudden change took place, for a violent gale set in from the north, blowing at the rate of 16 m. in the second (36 miles an hour). On other evenings also this northerly wind began to blow about 8 o'clock. It used to continue with undiminished fury all night; but at sunrise it used to drop almost as suddenly as it began, and at 7 a.m. the atmosphere would be perfectly still and clear, and so it remained until the usual westerly wind began again in the course of the morning. This phenomenon is, I suppose, characteristic of the summer only, for I did not observe it at any other season, at all events never so regularly. When we got farther south, this northerly night wind no longer put in an appearance; whereas the westerly wind continued all the summer, autumn, and winter, and went on growing more violent the whole time.

Next day, whilst we were resting at Camp XXIX, the same cycle was repeated, except that the northerly wind began as early as 5 p.m., and there was no antecedent calm. The westerly »trade-wind« veered round gradually and imperceptibly to the north, but did not attain its full force until 7.30 p.m., when it blew with a velocity of 16.9 m. in the second. At the moment it began the air was full of extraordinarily fine dust, so that the nearest mountains loomed through it like dim silhouettes or flat walls. Everything that lay loose on the surface of the earth was carried away, so that on the following morning the locality of our camp looked as though it had been swept clean with a broom. Thus here also, during the short intervals in which the ground is quite dry, the wind carries on its excavating work, though, as we have seen, that does not in general amount to much, owing to the fact that in the warm season the ground is generally moist and in the cold season is frozen. Yet however seldom it happens that the ground becomes as dry as it was in the vicinity of Camp XXIX, so dry as to fall a ready prey to the wind, nevertheless this circumstance does, in however slight a degree, serve to retard the filling up of the latitudinal valleys and basins, for the transporting power of the wind is naturally greater in the bottoms of the latitudinal valleys than on the mountain ranges that separate them, consisting as they do of hard material and covered as they indeed often are with snow. Perhaps the configuration of the country, when considered as a whole, plays a part which ought not to be overlooked. Camp XXIX lay in a relatively deep depression (4959 m.), bordered on the north by a range that rises to 5337 m., pass altitude, and on the south by a range that reaches 5210 m., pass altitude. Both these ranges should screen the intermediate latitudinal valley against precipitation, and as a fact the ground in it was considerably drier than it was both north and south of the same locality. Here too we came across small strips of drift-sand, though they were, it is true, exceedingly small, whereas drift-sand is entirely wanting in the moister regions that are more directly exposed to the precipitation. With regard to the grouping of this drift-sand, it did not escape my observation that it was always accumulated on the western slopes of the glens: that is to say in the meridional glens that slope down towards the south it is heaped up on the terraced escarpment on the right, while in those that run down northwards it is found on the left side. This arrangement itself tells us that the prevailing wind must blow from the west, as also that the night wind from the north which I have mentioned above is unable to effect any visible alteration in the arrangement of the sand. This suggests again, that the reason why this northerly wind plays such an unimportant part is that it blows for such a short portion of the year, whereas the westerly wind prevails nearly all the year round. With regard to the period of the rain, this coincides, so far as my experience goes, at all events in middle and southern Tibet, with the late summer; and the same would appear to be the case, though in a less pronounced degree, in the northern and eastern parts of the highlands. On this occasion we had got up on to the high plateaus a good deal earlier than we did the year before, and the precipitation then was certainly more copious than it was on this present occasion. During my journey through northern Tibet in the year 1896, which fell in the latter part of the summer and in the autumn, I observed that there was a plenteous precipitation. And even in the year 1901, during the

journey that I am now describing, when it got to be the end of July and August we experienced a far heavier rainfall, and it, to our cost, rendered the surface of these high plateaus soft and our march consequently all the more difficult.

On the morning of the 4th July there was a gentle breeze from the east; but it soon gave way to the usual westerly wind, which however blew not quite so hard as usual. For the most part we marched due south over gently undulating ground, with a sprinkling of grass. The bottom of the latitudinal valley, which we were now crossing diagonally, sloped upwards in that same direction. The watercourses that run towards the north were then dry. For a short distance however a number of springs of fresh, bright water bubbled up and gave rise to tiny, but deep rivulets, edged with thick moss. Around these springs there was excellent grass, which had attracted numbers of kulans and antelopes to the neighbourhood. The range which barred our path to the south did not look difficult. We made our way slowly up towards its northern foot, along which ran a watercourse coming from the west. This, at the point where we crossed over it, was a couple of hundred meters broad and about 15 m. deep, and sunk between steeply scarped terraces. It inclines gradually towards the north-east and pretty certainly makes its way to some lake situated farther east. At that time it did not contain a single drop of water. The surface still continued to be hard and good for marching on, and perfectly dry; at times the track of the caravan was marked by a trail of rising dust.

The main stream was joined by a number of contributory torrents from the range, and having crossed over it, we ascended one of these; it was rather steep, and its bottom was strewn with gravel. Here there was a good supply of kulan and wild yak droppings. The pass we were making for was 5210 m. above sea-level, and, as is customary in this severely denuded region, it formed a flat rounded arch. Yak moss was the only vegetation. This was therefore the second pass that we crossed over south of the Arka-tagh which possessed a considerably greater altitude than that range itself. In fact on the high plateau there are several ranges which, in respect both of their passes and of their summits, surpass the Arka-tagh; nevertheless this is entitled to be considered the most distinguished, not only because of its solidity, compactness, and unbroken continuity, but also because of its relative wealth of ice and snow. In this respect also we shall subsequently compare all the parallel ranges of Tibet.

We invariably approached the summit of each successive pass with a certain amount of expectant curiosity, for they almost always afforded us an excellent view of the country to the south. From our new point of vantage the country in that direction looked particularly inviting, the widespread, undulating plateau being diversified by quite insignificant stretches of heights of no great elevation. For several days we should be able to march without encountering any serious obstacle. The pure bright atmosphere allowed us to see to a great distance, in fact right away to the far-off horizon. It amazed me that from this point of view there was not a single lake in sight; but it turned out subsequently that there were two, though they were hidden behind the before-mentioned flat heights. On the northern side of the range we now discovered several large pools, which had hitherto been invisible. What a difference between the relief of the plateau to the south as compared with

the relief to the north! In the former direction the horizon kissed the great snowy mass which we had just climbed over by a pass situated at an altitude of 5337 m., and between it and us stretched a perfect labyrinth of minor ranges and crests rising one behind the other. In that same direction the landscape exhibited an extraordinary diversity of tints, the various shades of red predominating, while here and there we fancied we could discern little patches of yellow and green — grass and moss. Beyond and behind all gleamed out the snow-cap of the great snowy mountain, the culminating point of the entire scene. The whole was spanned by the pure blue vault of heaven — its colour also faint and evanescent. Nowhere did we see any sharpness or harshness of colouring; the distance toned down and subdued everything. This plateau scenery put me strongly in mind of the desert, and here also the desolateness was heightened by the deadly swoon in which these lofty regions appear to be wrapped. Apart from the tracks of wild animals there were no signs of animate existence; indeed, were it not for the tiny patches of yak moss, there would up in these altitudes be no organic life at all. A silence as of the grave on all sides, save for the whining and whistling of the west wind as it swept through the hills around, intensifying yet more the dreariness and the solitude. This country bears again no slight resemblance to the eastern Kuruk-tagh with its parallel crests.

A dry gravelly torrent led down from the pass, and soon entered a similar larger bed, the bottom of which was still moist from the stream which had recently died away in it. Camp XXX was pitched in a dry watercourse at an altitude of 5054 m. By digging down half a meter into its sandy bottom we came upon perfectly fresh water. Here again there was a fair amount of grazing, as well as jak-kak scrub. Next day near a spring that we found there were a great many partridges. At this camp we shot a couple of wild yaks.

During this stage the predominating rock was at first the usual brick-red sandstone; this was of course the cause of the prevailing redness of the landscape. But it nowhere cropped out as hard rock beside our route. In the side-glen however that led up to the pass we had a black, close-grained variety of rock, which though hard was generally severely weathered; this alternated with green schists. The only places where these rocks cropped out in the solid state were at the windings of the glen, where erosion had been at work. Generally speaking, the country consisted almost everywhere of extremely finely pulverised dust; this made going everywhere easy, as it readily supported the weight of our animals. At intervals it was dimpled with miniature hollows, all then quite dry, though a circle of salt round each showed that they sometimes do contain water. Far off in the east we still continued to see the great mass  $M_1N_1$  of the year before, and it now appeared that the range which we had last crossed over forms the immediate continuation of the mountain-mass in question.

The stage of the 6th July took us across a rather monotonous, though remarkably easy country, with good firm ground underfoot. It was perfect summer weather; indeed we sometimes felt it uncomfortably warm. The watercourse beside which Camp XXX was pitched runs first towards the south-east, but soon inclines towards the east, and almost certainly finds its way into a salt lake lying south of  $M_1N_1$ , which however was as yet invisible to us. We travelled for the most part

towards the south, the country being flat and undulating. On our left we passed a freshwater pool, still in part frozen over. Then came a tolerably broad, flat latitudinal valley, sloping towards the east; its altitude was 4970 m. Its lowest depression was situated not very far to the east of our route, and was occupied by small shallow lakes, or rather a marsh with occasional sheets of open water. In this locality the grazing was in every way excellent — that is for Tibet — being soft and full of sap; it grew on dry, sandy soil. Indeed up on the Tibetan plateau the best grass generally does grow on sandy soil. Orongo antelopes were also numerous,

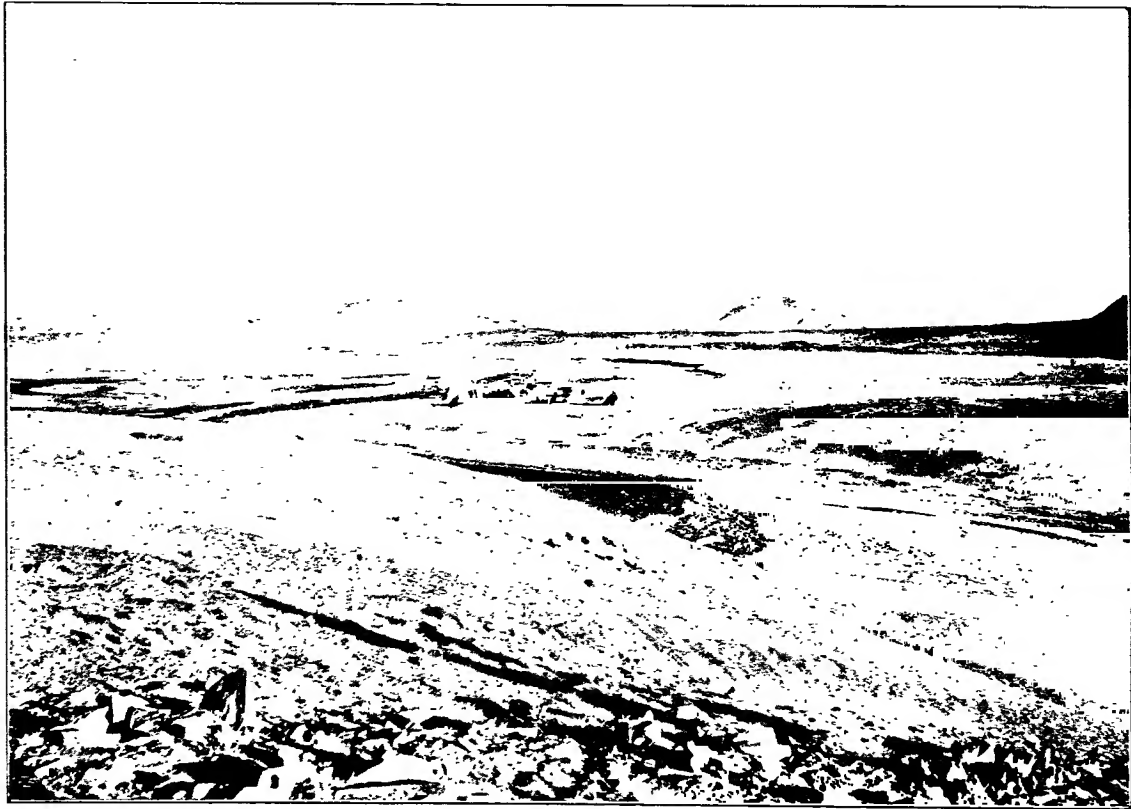


Fig. 354. CAMP XXXI.

and so too were the tracks of wild yaks and kulans. Having marched straight across this latitudinal valley, we slowly ascended towards a small rounded crest with a convenient pass at an altitude of 5056 m. But neither here nor at any other point during the whole of this stage did we come upon hard rock, we did not even see gravel or chips of stone; it was all either fine dust or fine sand. Over on the southern side we struck into a not very deep glen, running down between grassy hills, which picked up various other glens at the sides, until eventually it grew into a larger glen, the ultimate destination of which was a lake that we saw to the south, with a ring of glittering white all round it. At a certain spot in the main glen, where at three different places little springs gushed out, we formed Camp XXXI, at an altitude of 5020 m. Thus we had descended but a mere trifle from the last



pass. The quantity of water yielded by these springs was however so unimportant that the rivulet to which they give birth died away and disappeared only 20 m. below the lowest spring.

Nor did we perceive any outcrop of hard rock during the stage covered on the 7th July. All was soft, red sand, or dust, or mud; it was very rarely indeed that we saw any detritus of sandstone or quartzite. But there was grass, generally scanty, though in sheltered positions in greater abundance; in some places however there was no grass at all. Some of the *japkak* was living, fresh and full of sap, some of it dead and withered, and consequently hard; this latter made excellent fuel. There were numerous tracks of the three principal wild animals. The going was particularly good. First we descended slowly towards the lake, then ascended just as gently up again towards the next range. Thus during this stage we crossed over yet another latitudinal valley, in the middle of which lay the little salt lake I have last mentioned.



Fig. 355 CAMP XXXI.

But instead of following the watercourse which runs down to the north-west corner of the lake, we preferred to keep south-east along the eastern shore of the lake, where the ground was more convenient. This necessitated our crossing in the beginning over a whole series of contributory watercourses, which make their way from the range last crossed over down into the principal valley. In two of these we found springs like those at Camp XXXI; but after that we did not discover a single



drop of drinkable water until we reached the next camp. Hence this region was rather arid, in consequence of no rain having fallen for a considerable time back. The little lake, which nevertheless was the biggest we had seen since leaving Camp XXVI, was circular, or rather somewhat elliptical, in shape. Contrary to the usual practice, the north-south axis was rather longer than the east-west axis, so that the lake lies as it were athwart the valley. Its situation is however prescribed by a minor ridge, reddish in colour and in part grass-grown, which rises close to its western side. On the east shore also there are some hills. In this way there has arisen in the big latitudinal valley a self-contained basin, elongated from north to south. The shore, at the point where we struck it, consisted of fine reddish mud, which had been brought down and deposited by the torrents off the circumjacent mountains, though at that time not one of them contributed to it a single drop of water. The shore is exceedingly flat, and next the water was a snow-white strip, which derived its colour from a slight deposit of salt. So far as we were able to see, the lake itself lay in a basin encrusted with crystallised salt, precisely in the same way as the great salt lake which I examined the year before by boat. The lake water here was impregnated with salt to such an extent that the areometer projected almost half its length out of it, and I had to make a fresh mark on the

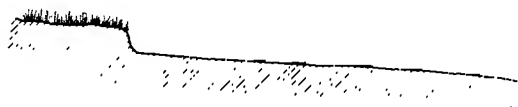


Fig. 356.

glass in order to determine the sp. gr., which amounted to 1.21. The grass nowhere reached down to the water's edge, but stopped suddenly short, as the accompanying illustration (fig. 356) shows, in the form of a rampart shorn transversely across. Below it comes the flat strip of shore, appearing to the eye almost perfectly level, and consisting of moist saliferous mud, so soft that to venture on it was dangerous. The water of the lake was of the most glorious colour, a pure deep blue, which was shown up by the ring of white salt all round it, with the red mountains for a background. The shape of the depression might have been inferred with a fair degree of accuracy from the relations of altitude in the neighbouring mountains. The strip of shore is very narrow on the east side, owing to the hills approaching within a hundred meters or so of the water-line. On the west side the slopes appears to descend rather steeply towards the water; and the strip of flat shore must be very narrow on that side also, if indeed it is not in some places altogether wanting. But on both the north and the south sides the circumstances are quite different; for the strip of shore, which appears to the eye to be almost level, reaches back to a considerable distance, and is moist, especially on the north, this being ascribable to the temporary watercourses that enter the lake in that quarter rather than to a subsidence of the surface of the lake. From this description it will be apparent that on north and south the lake is shelving and not very deep, while the deepest part, which however will not run to more than ten or a dozen m., if as much, must be sought for near the western side, where the shore slopes down at the steepest angle.

The *schor*-like, saliferous strip of shore, which, besides being absolutely barren, shows by its level smoothness that it must formerly have been under water, is a proof that the lake itself is shrinking; for there exist not the slightest grounds for believing that at different seasons the level fluctuates to such a remarkable extent as the amount of shore now exposed would indicate. We are precluded from making any such assumption by the simple fact, that, if such were the case, the lake ought at precisely this season, July, to have been at its highest, because it would have received not only the thaw-water from the snow that may have fallen during the winter on the neighbouring mountains, but also any moisture that may have been locked up in the ground itself by the frost. On the other hand an active evaporation goes on over the lake during the summer; but this factor again is in no slight degree counterbalanced by the circumstance, that a lake which is so salt as this will not freeze even in the severest cold, any more than the Usun-schor does. I do not of course mean to assert that fluctuations of level do not take place; but such as they are, they must be restricted to rather narrow limits. On the whole therefore the lake would at the present time appear to be pretty constant. But if we take note of its level over a relatively long period in the past, then it is pretty certainly shrinking, and its salt-impregnated strip of shore will grow steadily broader during the course of the centuries. Indeed one may venture to predict, that if the lake continues to develop in the future along the lines by which it has moved in the past it will in due time disappear altogether, leaving nothing but a salt-pan behind, of precisely the same character as the many salt basins that we shall soon meet with in middle and western Tibet.



Fig. 357.



Fig. 358.

In the next mountain-range we saw a gap to the S. 20° E.; but we found it impossible to steer straight towards it, because the hills on the east side of the lake are traversed by a vast number of eroded watercourses, which made marching very difficult, for we had to cross over them all transversely. These hills are arranged in narrow, greatly rounded ridges, consisting of gravel and sand, hard and firm, and completely barren on the surface. In the larger watercourse that comes down from the pass there was at this time no water, though a little distance away we saw a couple of small pit-like pools (fig. 357 and 358), not more than one or two meters in diameter, and filled with foul water, though it was not salt. In a well which we dug

in the bottom of the watercourse we obtained perfectly fresh water at a depth of only 0.56 m.; its temperature was  $+4.2^{\circ}$ . The water in the pools lay a good deal lower than the bottom of the watercourse. The surface of the little salt lake had an altitude of 4923 m., and Camp XXXII was only 20 m. higher. This was the lowest point we had touched since leaving the Arka-tagh; the last time we were as low as this was in the neighbourhood of Camp XVIII on the north side of the Arka-tagh. Subsequently to this I frequently had occasion to observe that these desiccated salt lakes, with their strongly saline shores, always lie at a relatively insignificant altitude.

On the 8th July we made our way slowly up the glen in which our camp had stood. The slope was insignificant, but it was hard work marching because of the attenuated atmosphere. Wild yaks and kulans abounded, and manifested no particular degree of shyness. The pass, at an altitude of 5059 m., possesses the usual flattened summit. Between the crest in which it is situated and the next range appeared several self-contained basins, each with a small lake in the middle, and separated from one another by ramifications and offshoots of the ranges. All these contained fresh water. The first three, which lie quite close together, are only one or two meters lower than the pass, though 130 m. higher than the salt lake; they are entered by several dry gullies coming from the west. In that same direction there appeared a latitudinal valley, but a good deal narrower than is usually the case. At the fourth lake we were stopped by the steep acclivity leading up to the next crest, and as the camels were unable to climb it, we turned off towards the east-north-east, striking into a dry torrential bed that ascends slowly in that direction. Soon however it entered a fifth little circular freshwater lake. On the south of it we came across two dry basins with distinctly marked shore-lines round them; these had formerly been connected with the fifth lake. Since their shore-lines are so sharply defined in the soft sediment, so soft indeed as to be readily modelled by the rain, it is safe to infer that the lake, or rather shallow pool, will, after a copious rainfall, rise so far as to run over and discharge its surplus water into the two southern depressions, both of which again are shallow. Had the dry period persisted somewhat longer, probably this pool, beside which we made Camp XXXIII (alt. 5041 m.), would likewise have disappeared. Its bottom is so flat, that not many rainy days would be required to fill it full. The grazing in its vicinity was worse than it had been hitherto, though still good enough to use. Wild garlic and jappak also existed. Traces of wild animals were common, and gulls were swimming on the small lakes.

Near the pass that we crossed over the hard rock cropped out in the form of a dark variety, very hard and finely crystalline, with a dip of  $49^{\circ}$  towards the S.  $75^{\circ}$  W., and this variety appeared to predominate all the way to the next camp, although always disintegrated. In one respect this part of the Tibetan highlands is different from the regions I had previously visited. Hitherto the ranges we had crossed over had with tolerable regularity been distinctly outlined and continuous, with great broad latitudinal valleys between them, each of which took us one or two days to cross over it. Now however we had entered a region in which the mountain crests not only come closer together, but are lower and smaller, and at

the same time relatively narrower, and their slopes proportionally steeper. It was plain that we had again to do with a mountain system, which had been split up by erosion in a more capricious fashion into several crests and valleys.

Before starting again we made a reconnaissance up a gently inclined glen, which brought us to yet four other lakes, equally as small as the preceding ones. Round the most easterly of these the mountains form a gigantic circle and can only be crossed over by a very inconvenient pass. Here we found wild yaks and kökmeks. This route I therefore abandoned owing to the unfavourable ground. I wished as soon as possible to turn off towards the south-east, so as not to come into contact with Littledale's route, being anxious to keep to regions in which no European had hitherto set foot.

With regard to the weather also a decided change took place here. At about 3 p.m. on the 7th July, when we were in the vicinity of the salt lake, the sky suddenly darkened and heavy masses of steel-grey clouds came rolling up, especially from the west; but as the wind was blowing from that quarter, a little sleet fell for the space of ten minutes only, and after that the sky cleared again and it became warm and summer-like as before. On the 8th July we had a shower of rain at noon, followed by the usual westerly wind. This was clearly the forerunner of the rainy season, for on the 9th July we had a copious downpour. In the forenoon it took the form of three violent showers of sleet, which suddenly gave the landscape a white and wintry appearance. After that a fine rain continued to fall thick and fast all day, so that the hitherto dry surface became wet and slippery, and for some little time greatly hindered our advance. At 10 p.m. the rain began to come down in torrents, and all our loads and tents were soon wet through, adding greatly to the weight which our already wearied caravan had to drag with them.

And in fact it soon became evident that the rainy season had set in in earnest. On the 10th July we had a good deal of downfall, for it rained and snowed all night long. When we started again our animals had to plough their way through the thick, soft mire, and both they and the men were soon carrying heavy masses of clay at each foot. One hail-shower was so violent that we had to halt, it was impossible to see where we were going to. The sun only showed itself for a short period, the sky being otherwise shrouded in impenetrable clouds. After we had encamped we were overwhelmed by a perfect tornado of rain. All the heavy black rain-clouds came from the west. Some of these passed over the mountains on the north or south without touching our latitudinal valley; but it was easy to trace their passage, as their dark fringes swept along the flanks of the mountains, leaving behind them white streaks of snow and hail.

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## CHAPTER XXVIII.

### TO THE GREAT NAMELESS RANGE.

At Camp XXXIII I made an important alteration in the constitution of the caravan by weeding out all the tired horses and camels, and leaving them to follow slowly on in the wake of the principal caravan. For our condition was now such that our first concern was to save what could be saved, and to endeavour as quickly as possible to reach lower regions farther south, where the grazing would be better. Starting again on the 10th July with a much lighter caravan, we travelled south, crossing over a small latitudinal valley, with a little lake in it farther west, down to which all the waterless, though still moist, rain-channels made their way. The first range we came to was crossed at an altitude of 5083 m. Over on its southern side a similar miniature lake received several rather large watercourses, though these again contained no running water. The ground everywhere, lately so dry, had first to be saturated before the water could begin to flow along the surface. From this point we followed what appeared to be a much frequented wild-yak track up to the main pass, and over on the other side we saw any number of wild yaks. But there was scarce any grass, only wild garlic and moss. We crossed over the pass (alt. 5186 m.), without any particular difficulty. All the same it appeared to form a rather important orographical boundary: to the north of it is a labyrinth of small mountains, while to the south is a latitudinal valley of considerable size. This I resolved to follow for a few days, partly to avoid overtaxing the strength of the caravan, and partly to get away from Littledale's route.

On our way down from the pass we crossed a whole series of watercourses all running towards the south-west, until they at length enter a larger channel, which subsequently inclines to the south-east and east. After that we continued towards the south-east, the country undulating gently or hardly at all, while the ground, almost barren, was firm and good to travel on. When at length a running brook appeared in the main watercourse, we halted and made Camp XXXIV at an altitude of 4982 m., especially as the grazing was passable. This latitudinal valley also lies relatively low. Between it and the preceding great latitudinal valley, with the salt lake, which is situated at approximately the same altitude, there thus intervenes a fairly broad swelling. To the south-west, south, and south-east we perceived a

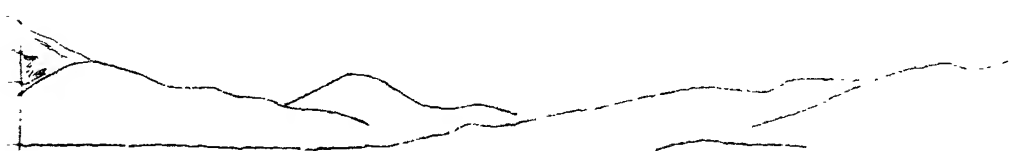


From a point north of the pass July 20 1901

From a point north of the pass July 20 1901



From Camp XXVIII July 1 1901



$D_1$  S 50° E

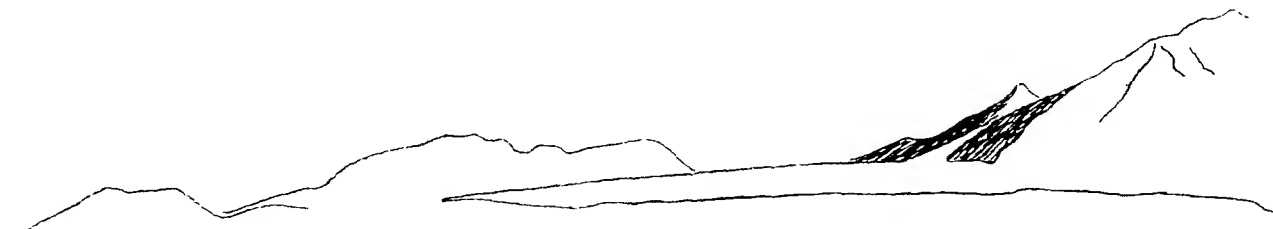
$E_1$  S 7° E

$C_1$

$C_1$

From a point north of the pass July 20 1901

Camp XXXVIII July 15. 1901



N 86° W

N 71° W

From a point north of the pass July 20 1901



N 85° E

S 44° E

SNOW

SNOW

From a point north of the pass July 20 1901

From a point north of the pass July 20 1901





new mountain-range, capped with fresh-fallen snow and of greater dimensions than any of the ranges that we had lately crossed over. To have gone straight over that gigantic mountain-wall would have been utterly impossible; our best plan was therefore to travel eastwards along its northern foot in the hope of discovering a gap by which we could get over it. One thing was at any rate clear, that we could not expect to find better grazing-grounds until we did get beyond it.

At the first little pass in this stage we found a close-grained variety of rock, which, though hard, was greatly weathered, with a dip of  $35^{\circ}$  S. Near the bigger pass was red sandstone, dipping  $35^{\circ}$  towards the N.  $35^{\circ}$  W.; then again, at the high pass, the recently mentioned hard, dark rock, thickly interpenetrated by white veins. Apart from this, we observed no hard rock, and only a little detritus in one place. From the first pass  $M_1 N_1$  were still visible to the N.  $35^{\circ}$  E.



Fig. 359. CAMP XXXV.

On the 11th July we travelled towards the east-south-east, following the broad latitudinal valley (which had an imperceptible slope in that direction), though without approaching notably nearer to the southern range, whose great snowy summits were now masked by ranges and crests of a sombre complexion. The scenery was, as it usually is in these latitudinal valleys, extremely monotonous. At first we kept on the north side of the stream, which flows due east. Grass and garlic occurred in small patches wherever the surface was rough; where it was perfectly level it was either quite barren or else bore a thin sprinkling of moss and japkak. There were numerous traces of orongo antelopes and kulans. What wild-yak dung there was dated from the preceding winter. The yaks appear to spend the summer in the higher snowy regions, but the winters down in the latitudinal valleys. And indeed we did find vast numbers of them on the top of the next range.

At the point where we forded the stream, in order to continue along its southern bank, its bed was very broad, though but slightly indented; its volume was

then about 3 cub.m. in the second, the water being bright. Where this stream goes to I was at that time unable to make out, but by means of a reconnaissance we ascertained later that at about 10 km. north-east of Camp XXXV it empties itself into a salt lake of about the same size as the one near which we formed Camp XXXII. This lake is encircled by mountains on the east, and the grazing round its shores was good. Marching south-eastwards away from the river, we soon became entangled amongst broken hills, and accordingly preferred to return to the lake-side, where the ground was level. Still this did not continue very far, for the river, describing the most extraordinary bends, threads a labyrinth of hills, some of which descend to it quite precipitously. As the going here was so unfavourable we



Fig. 360. THE SAME.

turned finally towards the south-east, and made for a flat pass, marching up to it across ground that is in part gently undulating, in part barren, in part thinly sprinkled with vegetation. We also crossed over a little depression, which clearly belonged to the same category of miniature lake as that at Camp XXXIII, that is to say its bottom was then dry, but it would unquestionably become filled during the rainy season then beginning. Camp XXXV (alt. 4954 m.) was pitched beside a pool containing salt water; we dug a couple of wells, but the water they yielded was likewise undrinkable. Consequently we had to send back to the river which we had last crossed over in order to procure water to drink.

At the little pass we found a reddish conglomerate, in part weathered, but otherwise hard, and of medium-grain, cropping out in an insignificant crest and dipping  $4^{\circ}$  towards the S.  $55^{\circ}$  E. Apart from this, we saw no hard rock in this latitudinal valley, the bottom of which exhibited various shades of reddish brown.

That morning the sky was heavily clouded, but we had no downfall until noon, when it began to hail, and afterwards it turned to rain. We could see the storm-clouds coming a long way off: they filled the valley as it were with a mass

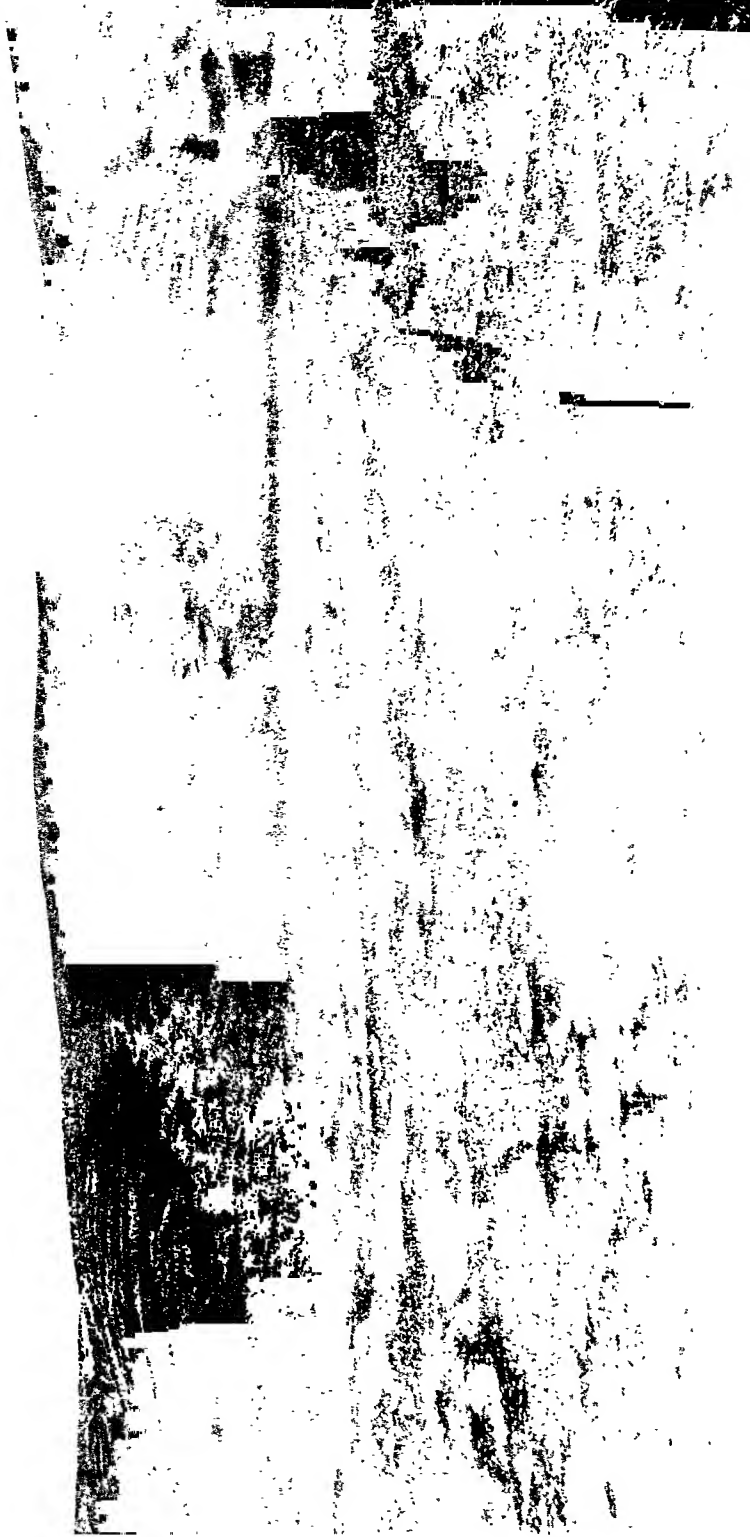
of blue-black smoke, the front part of which was defined with extraordinary sharpness. The effect was rather peculiar, the sky being all the morning serene except for one or two light flosky cloudlets, and all at once to see these great heavy masses of cloud come pouring into the valley, and career down it from west to east like a gigantic wave! The expanses of blue sky contracted and soon disappeared altogether; it was as though night were about to fall, in fact it was twilight. Whilst the storm lasted the thunder crashed deafeningly, though the lightning flashes were few and far between. The season had clearly begun in which the earth does not get time to dry between showers. The storm lasted until 10 p.m., and during the ensuing night not the slightest speck of cloud dimmed the wonderful brilliancy of the stars. It may indeed be laid down as a general rule, that the days were blowy, with plenty of rain or snow, while the nights were still and bright. After the actual rainy season set in, it rained or snowed also during the night.

July 12th. During the night we had a violent snowstorm, the snow being very wet, and in the morning the sky was everywhere covered with thick impenetrable clouds. Yet, contrary to expectation, it neither rained nor snowed during the day, though all the greater was the quantity that fell upon the red mountains.

The next stage led us south-east, diagonally across the great valley and gradually nearer to the immense range on the south, and as we advanced, the scenery essentially changed its character. Hitherto we had moved along the bottom of the great broad, open valley, with an uninterrupted view of the mountain-ranges on both north and south; now however we became entangled amongst stretches of small rounded hills and ridges, drawn out partly from east to west, partly from south-west to north-east, and generally restricting our range of vision. This country was clearly more unfavourable, for each of these ridges and chains of hills had to be crossed over by a succession of low saddles. Between the first two ridges runs a latitudinal valley towards the S.  $78^{\circ}$  E., but without any visible watercourse; while at the end of it we could distinguish a pure white expanse, a salt lake for the most part dried up. Although our course led us near the lake, nevertheless we did not go right up to its shore. It must however be in a very advanced stage of desiccation, for the reaches of open water were few and far between, while the rest of the lake-bottom consisted of a perfectly level area of bare crystallized salt. This lake occupies one of the lowest depressions of the latitudinal valley. In its vicinity are several pools, some with, others without, water, but all incredibly salt. The lake is oblong, and about midway along its southern shore it is joined by a stream, which in the lower part of its course winds in sweeping curves through the hills. Its current was approximately at a standstill, to the eye almost stationary. Although at the first glance the river thus appeared to be large, yet its volume was really minimal, a very small fraction of a cubic meter. Its banks, and even the river-bed, are composed of extremely fine red sediment, some of it so soft and treacherous that a man might very easily have been drowned in it, though in other places it was hard and compact, and bore easily. On the left side, above the ford, was an extremely shallow marginal lake, which needed but a slight subsidence to disappear altogether. Immediately below the ford the river divides for a short distance into two arms, which embrace a low mud-island between them. Still farther down it forms a sort

of mud delta, which the water flows over, and below that again the arms reunite into one common bed before entering the lake. There are also various salt pools on the east side of this river, which flows, at any rate in its lower part, towards the north-east. When first we caught sight of this stream, we greeted it joyfully, because for two days our caravan animals had had nothing to drink. I hardly expected to find these mountainous regions so poorly supplied with water, especially now that the rainy season had fairly begun, and yet we had marched two entire days without finding so much as a single drinkable pool. The reason of this must be that the loose, pulverised, disintegrated matter absorbs the water, so that it is unable to give rise to running brooks; besides which, in this valley the mountains on both north and south stand a great distance away. The only place where we found water was in the vicinity of the salt lake (alt. 4972 m.), namely in the lake itself, in the pools, and in the river, but the water in all these was heavily charged with salt. The earth in all that neighbourhood must consequently be strongly impregnated with salt. If my observations in central and western Tibet will permit of application here, then I should venture to suggest, that this lake was formerly much more extensive than it is now, and possibly the numerous pools beside it were once integral parts of the lake itself. From the extraordinarily slight fall in the lower part of the river, I should say even a very slight rise in the level of the lake would be followed by a considerable increase in its area, in which it would again incorporate several of the pools and the whole of the lower part of the river. When however the lake shrunk to its present contracted area, it left all round it a ring of saline deposits of varying breadth, but these in consequence of the conjoint activity of disintegration, erosion, and sedimentation have subsequently become covered with a layer of powdery earth. And as the lower part of the river has to cross over this former portion of the lake bottom, it is inevitable that its water should become as bitterly salt as we found it to be. This explanation of the salinity of the river appears to me now to be more probable than that which I noted down on the spot. I then fancied that, as the level of the river at the ford is only a shade higher than the level of the lake, if some other stream, originating after a violent local rain farther east, were to enter the lake at its eastern end, it might chance to raise the lake level sufficiently to drive the lake water up into the river which we had forded.

After leaving the last of the salt pools behind us, we crossed over yet another series of ridges, though these were less rugged than those around the lake. By this we had, it was evident, passed beyond the saline area of the lake, and then after climbing a little towards the south-east we at length hit upon a small freshwater spring in a ravine. The scenery continued to wear the same aspect all the way to Camp XXXVI, at an altitude of 5057 m. Grass was exceedingly sparse, but there was *japkak*. Skulls and other skeletal parts of kulans and orongo antelopes were extraordinarily numerous in this region; bleached and rotting bones littered every dry watercourse amongst the ridges. They conveyed the impression that the animals had deliberately sought out this desolate region in order to be able to die in peace; it is quite out of the question that all these bones should be the result of excursions by Tibetan hunters, for not only are they scattered about everywhere,



*Lynx t. b. lagrelius & Westphal.*

VIEW TAKEN EN ROUTE, JULY 12. THE DOGS MAKING AN ATTACK ON A WILD YAK. THE HILLS,  
IN WHICH NO HARD ROCK IS FOUND, ARE CHARACTERISTIC OF THE INTERIOR OF TIBET.



but we had hitherto seen not the very slightest trace of human visitors. Just south of the spring I have mentioned we observed a solitary old yak bull, grazing on the slopes of one of the usual ridges. Strange to say, he exhibited not the remotest signs of shyness: had he ever come into contact with Tibetan hunters, he would certainly have shown more prudence. Although our dogs made a fierce attack upon him, they were unable to make him take to flight; he simply put himself in an attitude of defence and waited. Thus the Cossacks were easily able to bring him down. I only mention this insignificant episode because, whilst the yak was busy with the dogs, I succeeded in getting close to him with my big camera and photographed him. He figures in the middle of Plate 80, which also gives an idea of what the ridges in that region are like.

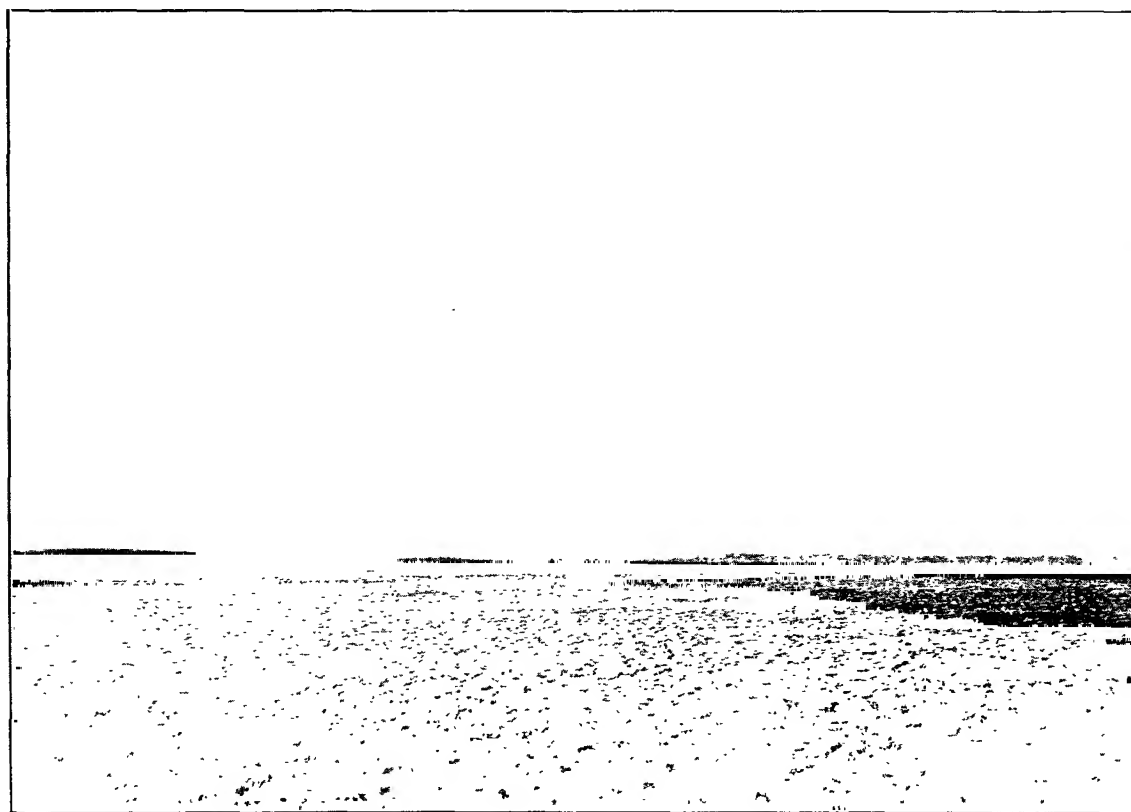


Fig. 361. LOOKING N 67° E FROM CAMP XXXVII.

Only once or twice during this stage did we come across hard rock in the shape of a very close-grained variety; everywhere the soft material prevailed. Occasionally we caught glimpses of the great snowy range to the south; I foresaw that we were going to have tough work to get over it. To the south-east there was simply a host of mountains.

On the 13th July our great latitudinal valley resumed its normal appearance, stretching flat, broad, and open towards the S. 60° E., a direction that is not at all usual, and presumably only local, for on the whole the valley no doubt runs east

and west. Despite the snow and rain, the ground was hard and firm, and not even the slightest saddle interposed itself in our path. Both north and south we had low crests at a pretty considerable distance away. That on the south, which appeared to be double or even treble, was not able to mask the main range which towered up behind it, and which by reason of its immense altitude presented anything but an inviting appearance. The lowest part of the valley is occupied by two quite insignificant salt lakes, and into them run from every direction a number of dry and not very distinctly marked watercourses. The grass thinned out towards the east, the moss was more abundant, but perfectly barren tracts were quite common. In the neighbourhood of our camp we came across a variety of grass to which my Mongolian Lama gave the name of *buka schirik*, or 'yak grass'. On the great road between Tsajdam and Lhasa, this is said to appear four days before the first Tibetans are encountered. There was any number of wild animals; the wild yaks, the kulans, the orongos all formed small herds, and besides these there were hares and partridges.

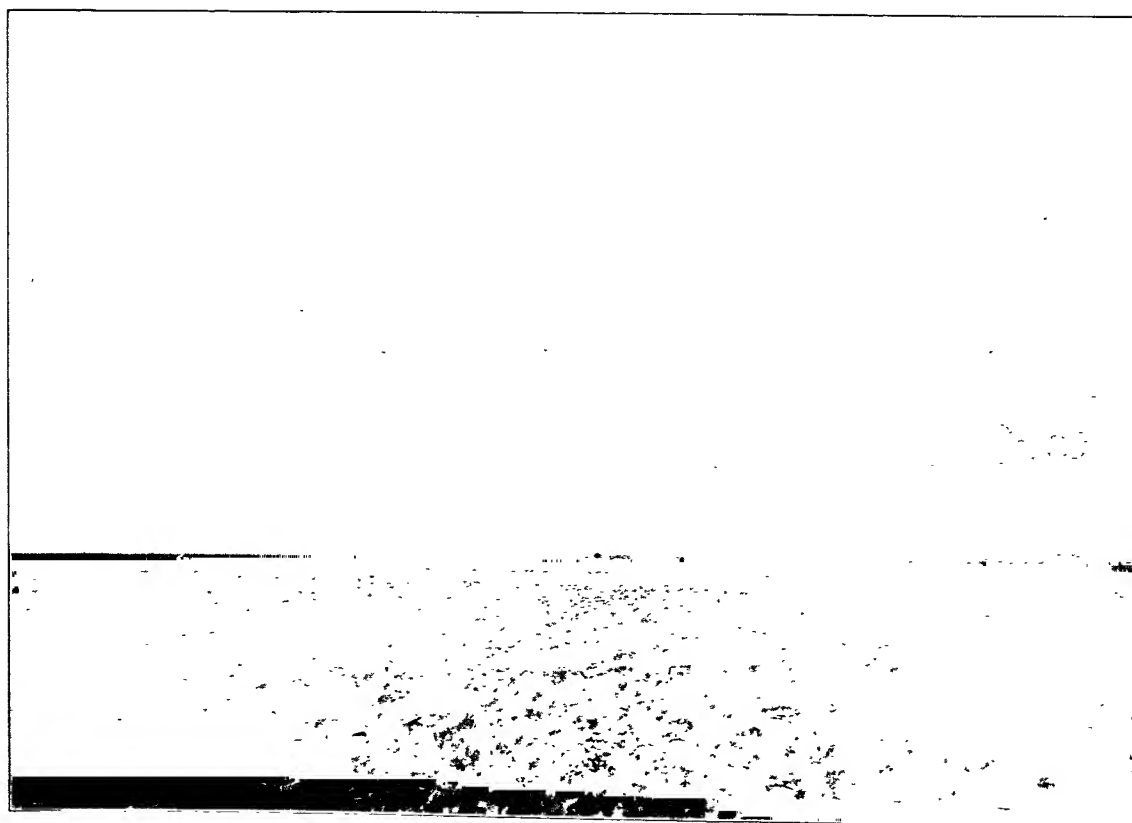


Fig. 362. LOOKING N 5 E FROM CAMP XXXVII.

We directed our course towards a minor projecting spur; but before reaching it, crossed over a river with several arms, running towards the north-east and carrying about 5 cub.m. of water, only in part clear. This came down from the southern range, which was now at no very great distance away. The nearest foot-hills on



that side appeared to be pierced by the glen down which the river flows, and which afterwards runs diagonally across the latitudinal valley. At Camp XXXVII, which was situated at an altitude of 4968 m., the left terraced bank of the river was steep and distinctly marked; on the opposite or right side there was no terrace at all, but a very level stretch of steppe, with a thin sprinkling of miserable grass, yellow in colour, yet nevertheless not withered. The river ends in a moderately sized, elliptically shaped lake to the north-east of our camp. On its southern shore rises a minor ridge, and through a gap in it, by which the river makes its way, we

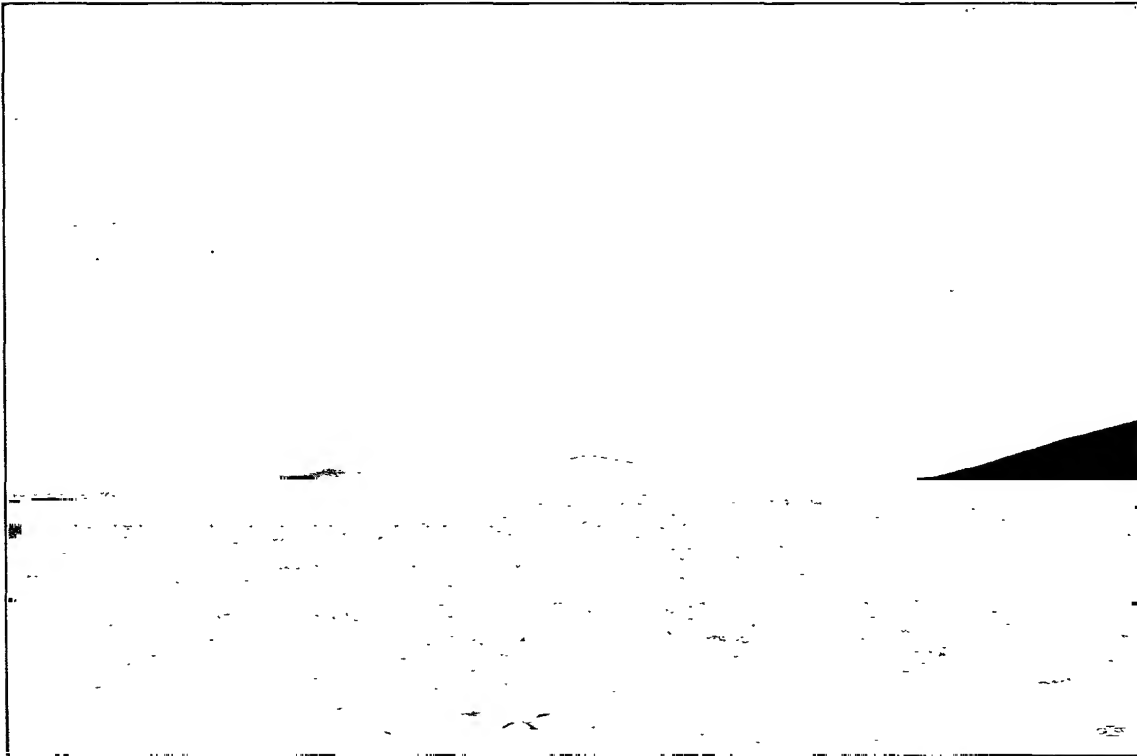


Fig. 363. LOOKING S 35° E FROM CAMP XXXVII.

caught glimpses of the lake's blue waters. To judge from the somewhat considerable velocity, and the fact that the lake was situated about 10 km. from the camp, I should infer that the former lies at an unusually low absolute altitude, and seeing that it is the terminal lake of a pretty extensive self-contained basin, I should also say that it contains salt-water. A short reconnaissance told us that there was relatively good grazing on its southern shore, but it lay too far out of our way for us to visit it.

We saw hard rock nowhere during this stage. The weather was as usual: during the night it had rained; in the afternoon there was hail, snow, and rain alternately, and sometimes they came down so violently that we had to stop, dismount, and crouch under the shelter of our cloaks. We spent the next twenty-four hours in the same place, and during that time it sometimes hailed also.

From Camp XXXVII we saw to the N.  $43^{\circ}$  E. and N.  $68^{\circ}$  E. great snowy bosses belonging to the range that shuts in our latitudinal valley on the north.

On 15th July we rode on farther towards the south-east and east-south-east, still in the same broad valley, and consequently to the accompaniment of the same uniform scenery. For some time we marched along the base of the nearest low hills on our right, hills in which a number of springs bubble forth and form small torrents, traversing soft and dangerous marshy ground. But upon getting past the end of these, we saw the great snowy mass of the main range standing out in all its glory, gleaming white from base to summit. It was palpably impossible to get over the range here by striking due south.

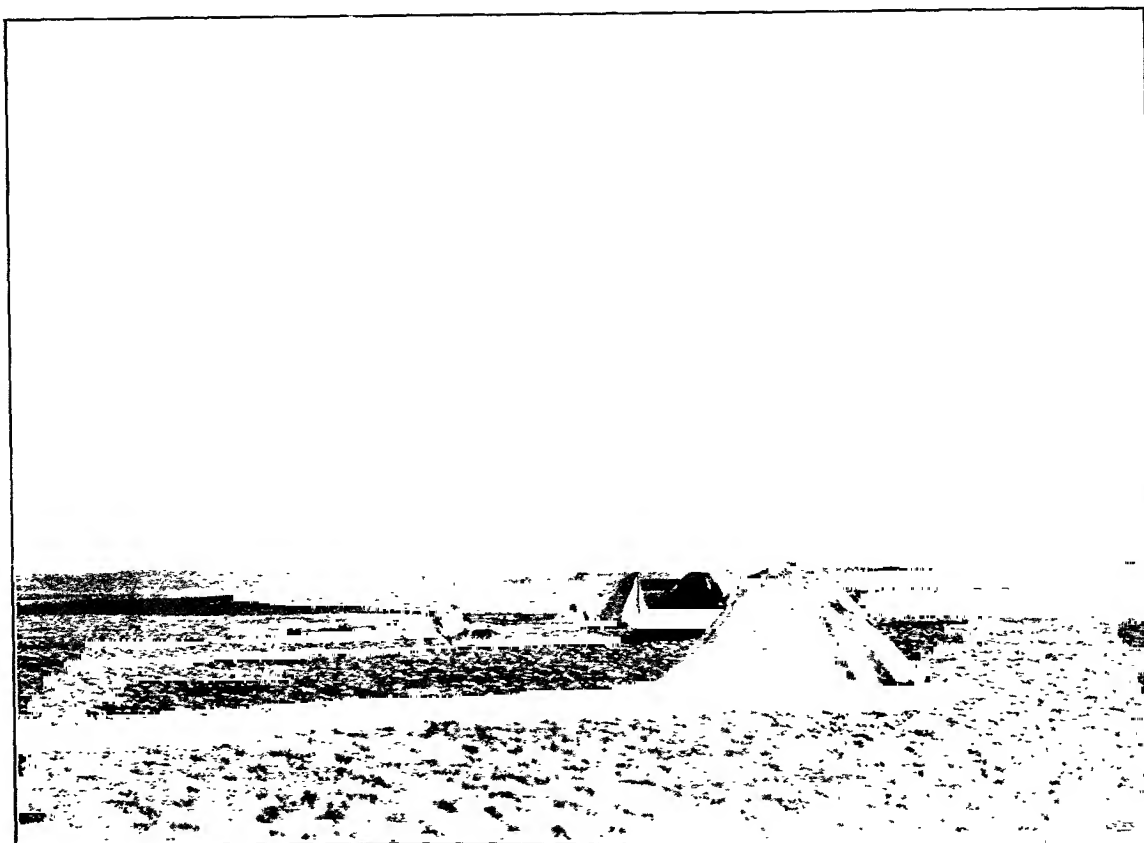


Fig. 364. LOOKING S  $43^{\circ}$  E FROM CAMP XXXVII.

At length we came to a river of decidedly imposing dimensions, in fact it was greater than any stream we had seen since we left the Tarim; the Tscharklik-su is quite small in comparison with it. At the point where we forded it, it was divided into fully a score of arms, not reckoning quite as many minor connections. A provisional estimate gave a volume of 23 cub.m. in the second; its maximum depth amounted to 0.60 m., but the mean depth was quite insignificant, for the channel was a good kilometer broad. The water was only partially clear, its general tint being grey, like diluted milk. That it was excellent to drink I need hardly observe, since

it came direct from the immense dome-shaped snowy mass on the south. It approached the spot where we were from the S.  $33^{\circ}$  E. and proceeded on towards the N.  $24^{\circ}$  W., and was clearly bound for the lake that lay to the north, although we were not able to observe this directly and *de visu*. Probably the river beside which we pitched Camp XXXVII effects a junction with this main stream, though this too I was unable to ascertain with certainty; possibly again they enter the lake separately at different points on the south. Almost the whole of the volume was flowing in the western half of the channel, and on that side the hills descend steeply to it, whereas the right bank is flat — exactly the same as in the case of the river at Camp XXXVII. In the right half of the channel there were only a couple of the smaller arms. A short distance below the point of crossing all the arms appeared to converge together into a single bed. In the distance we saw how a smaller tributary, formed by the recently mentioned springs, joined the main stream. The bottom of the river was hard throughout and nowhere yielding; in fact, it consisted of fine gravel. Had the whole of the flood been collected into one stream, we should probably have had great difficulty in getting across it. During the afternoon, after the thaw-water of the morning reached it, it would certainly grow bigger.

Above the place where we forded it, we saw a herd of 75 wild yaks on the hills on the left bank. Kulans, antelopes, hares, and hawks also appeared in this locality, and after we encamped bears and wolves.

We now ascended slowly towards the east-south-east, marching on a flattened ridge towards a snow-capped mountain-mass, which had no connection with the southern range. We gradually approached the left bank of a river which issues from a glen cut through this mass. The stream flows towards the north-west and appears to make for the lake in the latitudinal valley, so that this lake is richer in affluents than any of those we had hitherto come across, with the possible exception of the lower Kum-köl. This is to be attributed in no slight degree to the fact that the drainage-area around the lake is so extensive, and above all to the circumstance that it is situated in the vicinity of such a great mountain-range, which, in respect of both relative and absolute altitude, is very much higher than any other range in that part of the interior of Tibet, and which consequently is in a position to arrest a considerably greater amount of atmospheric moisture than its neighbours. The precipitation which it thus arrests forms extensive *firn* areas, quite sufficient, as we shall see presently, to give origin to glaciers. Then, when the short summer sets in, these expanses of snow and ice begin to melt, and it is their thaw-water which gives rise to the three large rivers that we crossed over between Camp XXXVII and Camp XXXVIII, and of which the middle one is incomparably the biggest. We found an exact parallel to these circumstances on the northern side of the Arka-tagh; there several big rivers flow down from the snow fields and ice-fields of the range into the depression of Kum-köl. In the case of both ranges, of this new chain as well as of the Arka-tagh, one readily observes that the volumes of water which stream down the northern slope are far more copious than those which pour down the southern versant. Nor do the relations of relative altitude on the opposite sides of each range appear to exercise any at all noteworthy influence. Precisely the same circumstances exist in the Himalayas, where the gigantic streams of the Indus and the Brahma-

putra derive by far the greater portion of their volumes from the northern flank of the range.

We pitched Camp XXXVIII in the outlet of the glen out of which the last of the three rivers emerges upon the flat latitudinal valley. The absolute altitude here was 4929 m., while the middle river, the largest of the three, lies as low as 4892 m. The grazing at this new camp was thick and full of sap, although short and rather hard. At the foot of the hills on the left bank quite a string of springs gushed out, and of these some formed tiny basins of clear water, rimmed round with fresh green grass and moss. In most cases the diameter did not exceed one meter, but they were half a meter deep. In vertical section they generally presented the appearance shown in fig. 366. During the night they usually became covered with a thin sheet of ice. There was here any quantity of yak-dung. A little lower down we came upon a brood of quite young wild-geese, and partridges also were abundant. In a word, this was one of the best localities we had seen for a long while. The hills on the bank screened us against the wind.



Fig. 365. LADEN CAMELS.

During this stage we did not find hard rock in a single spot. The weather was unusually good. Sometimes we even felt it oppressively hot, though at 1 p.m. we had a passing hail-shower. On the following day the hail was far more violent, and in a trice the ground was whitened over; but within an hour the hail was all gone again.

It was at this camp, Camp XXXVIII, that we first came into contact with the Tibetans. They were three yak-hunters, who with a couple of horses and a score of tame yaks, were encamped a few kilometers to the north-east, at the foot of a spur of the mountains on the right bank of the river. Unfortunately no sooner did they become aware of our presence than they hurriedly disappeared, and we conse-



*Lepido, A. B. Laguerre & Westphal*

LOOKING NW. FROM CAMP XXXVIII.



quently lost the information that they possibly might have been able to give us. We found at their camp two yaks' skulls and other bones, and their trail seemed to indicate that they had gone off to the east, the direction from which they had also come. I have no doubt they make use of an easier pass than that by which we subsequently crossed over the southern range. They come up into these northerly mountainous regions in order to provide themselves with yak meat for the winter; but they seldom or never go farther north than this; at any rate we had hitherto observed no trace of human beings south of the Arka-tagh.

On the 18th July we pushed on south-east up the rather narrow glen. It was now that we actually began the climb which was to take us over the biggest of all the mountain-ranges in this part of central Tibet. In order not to weary the caravan unnecessarily, I had sent out, whilst we were resting, a couple of scouts, who came back and reported

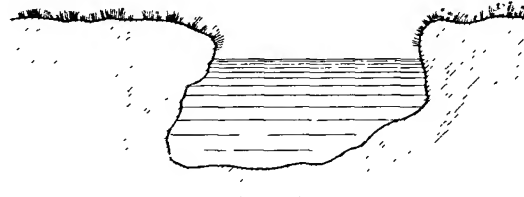


Fig. 366.

that this route was practicable. The glen, which is squeezed in between rather high hills, those on the right side being especially big, afforded excellent going: it was very rarely that the surface was soft and marshy. Here too a great number of springs bubbled forth, some of which gave rise to basins, great or small, while others ran off as thin rivulets and made their way directly into the main stream of the glen. This clings at first to the hills on the right bank, but higher up, where the glen contracts, it crosses over to the opposite side. Here, where it was divided into a big arm and several smaller ones, of cold, semi-transparent water, we crossed over it. At noon its volume amounted to at least 10 cub.m. and on towards evening it increased still more. After that the glen describes a curve towards the south, while the hills on its left bank become low and flat; and amongst them, after we had once more crossed the river, we found it very comfortable marching. From this point of vantage we had an excellent view of the glen, which now grew broader and broader, the stream breaking into several arms, the greater number of which were however still frozen over. These sheets of ice are formed on the spring-water during the autumn and winter, but they were then so soft and rotten that they would undoubtedly all melt away during the summer. If they do not do so, they would have been thicker and more extensive than they actually were. The muddy bottom of the glen both underneath these patches of ice and at their sides was extremely soft and treacherous. The grass still accompanied us, although it was both scanty and poor in quality. On the right of our route, that is to the south-west, we now beheld in all its majesty the great snowy mass C, D, E, F, and to the east-south-east a dome-topped, free-standing snowy mountain, which even at the beginning of the previous day's march had appeared to us to be quite close at hand, although we failed to get near it even on this the second day. The glen now expanded into a large open arena, and we forded its stream for the third time at a spot where there was not a vestige of ice. After that we kept along the foot of the mountains on the right side of the valley. Soon we came upon a small triangular lake in the entrance to a side-glen. By this the grazing was again growing good; the soil con-

sisted for the greater part of broken sand. We pitched Camp XXXIX between two small basins of bright spring water, in which there was actually a species of small fish. The altitude was 5124 m., so that since leaving our last camp we had climbed up almost 200 m.

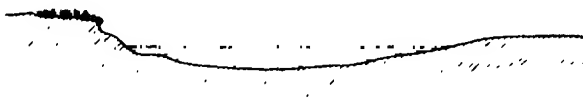


Fig. 367.

At the spot where we forded the stream for the first time there was a black or dark-green fine-grained schist dipping  $68^{\circ}$  towards the S.  $22^{\circ}$  W.; higher up the schist assumed a more reddish tinge.

Yak-dung and yak-bones were both very common in this locality. We saw a flock of eleven kökmeks. Besides these there were kulans, hares, partridges, ravens, and gulls (*hangvit*). The weather was unusually favourable, neither wind nor rain nor hail. The air was filled with swarms of inquisitive little flies and the gad-flies were more numerous than usual.

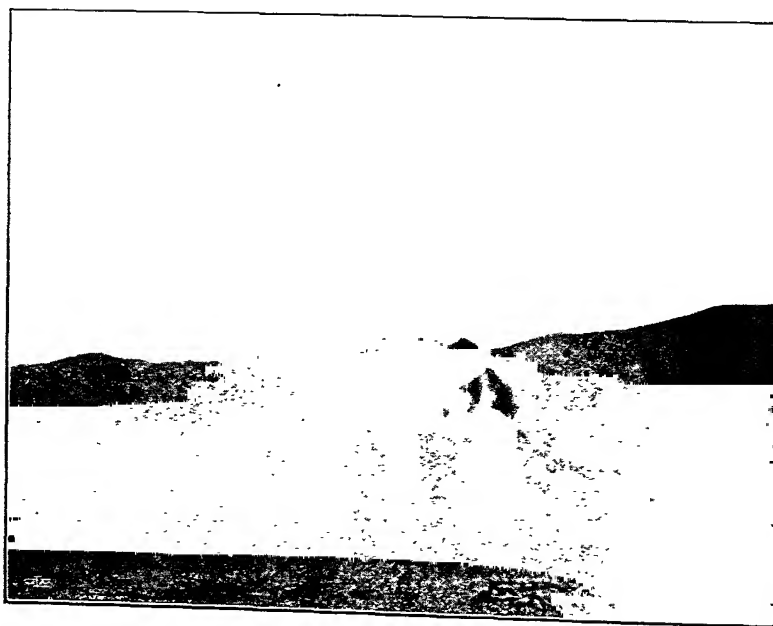


Fig. 368. SEARCHING FOR GRASS.

July 19th. During the night there occurred one of those abrupt and sudden changes of weather which are so characteristic of high Tibet. The difference between winter and summer cannot exceed that which showed itself between these two days. On the 18th warmth, sunshine, light, and swarms of flies: on the 19th the sky was everywhere covered with impenetrable clouds, heavy and louring, hanging like dirty tufts of cotton above the crests of the mountains, which they entirely hid from sight.





*Lt. J. A. B. Lucetius & Westphal*

LOOKING N.E. FROM CAMP XXXVIII.



Nor was it long before the hail began to smite us, and that with terrific force, and the tempest lasted for several hours. Sometimes it was impossible to get a glimpse of the country in our neighbourhood. During the second half of the march neither hail nor rain fell, but the massed clouds continued to be quite as dense and an unearthly darkness prevailed all day. In all my journeys in Tibet I have found it an almost unfailing characteristic of the mountain-ranges that they are practically always enveloped in clouds, and that precipitation is always taking place, whereas the relatively low latitudinal valleys on both sides are, thanks to the lofty bordering ranges, relatively protected against hail and rain. This is at all events true of the summer and spring; though from the accounts of Bonvalot and Grenard the quantity of cloud and the amount of precipitation are both less in the winter.



Fig. 369. RELATIVELY GOOD GRAZING.

We now directed our steps towards the south-east and south-south-east, still continuing up the glen, where the surface soon became almost completely barren. We again drew near to the river, and at the point where we next forded it it was divided into only two arms, containing together a volume of 8 cub.m. This great falling off was due not only to the weather and the time of day, but also to the fact that lower down the stream is joined by so many tributaries. After that we did the rest of the ascent on the left bank, sometimes in the bed of the stream, though this was in places dangerously soft, and sometimes on the hills that overhang it. Except for a few rare patches of short, thin grass, the vegetation was now reduced to moss. The glen had again grown flat and open, and the view extensive, in so far as it was not obscured by clouds or hail. In three separate localities we saw traces of hunters' camps, the easily recognisable sign being three sooty stones arranged to support the cooking-pot, with ashes in between them. One of these

camp appeared to be not more than ten days old, and had probably been formed by the three yak-hunters whom I have recently mentioned. Generally, yak-bones were quite common in this locality. On the other hand we saw no living yaks, though we did observe recent droppings. It seemed as if the animals had been frightened away not long before. The kulans too were shyer than usual, although the Tibetans never interfere with them, for they do not eat kulan's flesh. In no part of Tibet that we had yet visited were wild yaks more universal than in this particular region, and in this I saw a fresh proof of the correctness of my inference, that these animals spend the summers in the very highest regions, close up against the perpetual snows.

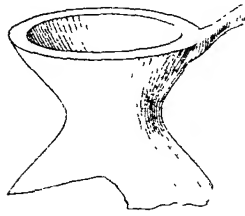


Fig. 370.

Keeping to the right of the pyramidal, free-standing snowy mountain, we proceeded almost due south. In front of us was the flat swelling of the pass. When seen from the distance, the acclivity leading up to it had appeared favourable and convenient; but these high passes in Tibet are deceitful. In one place there was an ice-sheet in the bed of the stream. Several small pools contained fish, including even some that were completely cut off from the river, though it is true the fish were individually small. Partridges occurred near the camp. While the left bank was entirely barren, there was some grass on the opposite or right bank. In five or six places in the vicinity of this camp we saw old indications of Tibetan visitors; at one of these we picked up the handle of an earthenware vessel (fig. 370). If we may argue from this, it would appear that the inhabitants of the extreme north of Tibet are acquainted with this pass, to which destiny had led us. The only thing that would induce them to travel across that immense range must be the prospects of good yak-hunting.

Our new camp stood at an altitude of 5288 m., so that we had ascended yet 164 m. more since we left our last camp. Not very far north of this latter we passed a white and yellowish variety of rock resembling quartzite, and dipping  $53^{\circ}$  towards the N.  $58^{\circ}$  E., as also a sandstone or clay-slate, varying from light green to grey and dipping  $17^{\circ}$  towards the S.  $50^{\circ}$  W. In one place we observed several loose pieces of a rock strongly charged with magnetic iron; the pieces were perfectly round, and polished, and had bright surfaces. Apart from this we saw hard rock nowhere, nothing but finely pulverised material, except in the river-bed, where there was gravel. I searched, but searched in vain, for indications of a former more extensive glaciation in this region. There were neither morainic ridges nor erratic blocks to betray that glacier arms, which still exist higher up, had ever descended farther down into the glens. And yet this was just the region, where the loftiest summits of the range are still capped with ice, in which one would expect to find such traces.

The 20th July was one of the heaviest days our caravan ever experienced. Very early in the morning the sun showed himself for a space, but no sooner did we get started than the blue-black clouds came driving up from the south-west, shrouding the country in gloom and entirely blotting out the snow-clad, ice-bound summits. The downfall took the shape of hail, snow, and rain, sometimes all three falling at one and the same time. The mere climb over a range so lofty as this is

in itself sufficiently exacting because of the exceeding attenuation of the atmosphere, but it is made doubly difficult when you have such a storm in your teeth. You get wet through and almost frozen. It is hard work to go on map-making, when your view is restricted; and you cannot help pitying the poor caravan animals which at every step sink into the softened ground, for by this the surface was converted into a pudding of mire. After the most violent of the hail-showers had lasted an hour and a half, the face of the country was everywhere perfectly white, but both hail and snow quickly melted in the slushy mire. During the second half of the march the clouds parted and we obtained a view of the magnificent glaciated mass on the right of our route.

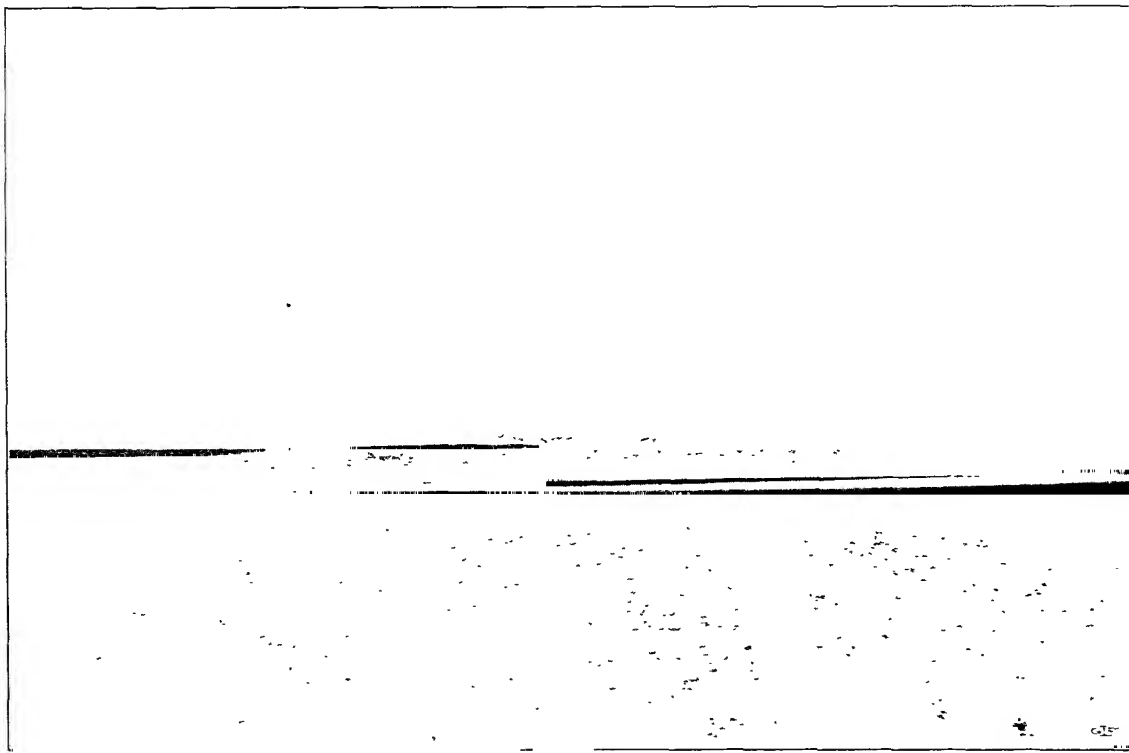


Fig. 371. LOOKING FROM CAMP XL TOWARDS THE N 20 W.

A little way above Camp XL three streams of about the same size converge from as many different directions — one from the east or east-south-east, another from the south-west, both issuing from glaciers. The middle one of the three led us up to the pass itself; it too was fed almost entirely by glacier water. We kept to its left side. The fall was sometimes so slight, that the water just crept along with a slow and noiseless movement, its bed being only 1 to 2 m. broad, though often 1 m. deep; in vertical section it resembled the annexed illustration (see fig. 372). In the deep basins or pools that form at the bends of the stream the water was as clear as crystal and of a lovely blue-green colour. The banks formed soft and frequently overhanging ramparts, with tender, green yak-grass, as soft as velvet, the

kind that the yak alone can eat, owing to the horny appendages of his tongue. Our caravan animals made no attempt to consume it: it was too short for them to bite. In the deep pools we found also, even at this stupendous altitude, the same species of small fish that I have already mentioned. Their presence seems to prove that at all events some portions of these streams do not freeze over entirely during the winter, but are kept open by springs. At that season they were keeping to the deep pools, in which there were the gentlest of eddies, indeed the water was almost motionless. It was only in the shallow parts that the water rippled.

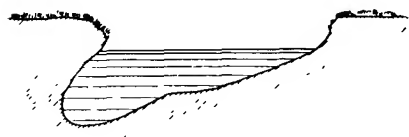


Fig. 372.

Above Camp XL the ground was actually so level, that had it not been for the flowing water, it would have been impossible to tell there was any fall at all. But very soon the ascent made itself both seen and felt. My fond hope, that we had already reached the top of the pass, was thus deceived, and upon the clouds thinning away a little,

we saw that we still had some distance to climb. In certain places our advance was made more difficult by the character of the ground, which put me in mind of a great swamp, in the wet clay and sand of which the animals' feet were constantly being sucked fast.

Soon we were enveloped on both east and west by stupendous mountain-masses, the craggy swellings of this immense range. Amongst them the two bosses crowned with perpetual snow stood out especially conspicuous; it was from them that all the streams originate which we had crossed over during the last few days, those namely that make their way down to the lake north-east of Camp XXXVII. From the great snowy mass on the west, that is quite close to us on the right hand, four glacier arms proceeded, each bursting as it were out of a rocky gateway. They are bigger than one would expect in a region where the perpetual snow is restricted to situations at such a vast altitude that the areas which reach up high enough are infinitesimally small. The most southerly of these glacier-arms is traversed by a great number of transverse crevasses, and has such a steep fall as almost to be like a staircase. In the arm which lies next it on the north, the crevasses are marginal only. Of the actual ice itself we saw nothing owing to the thick covering of snow, through which however portions of the moraines of no inconsiderable extent projected. So far as I was able to judge from the distance, these exposed portions of the moraines consist of fine material, that is to say gravel; but no fragments of rock were visible. The moraines become beyond doubt lost in the yawning lateral crevasses, for there are no front moraines worth speaking about. The material which is carried down from the mountains on the ice appears in general to be so fine that it is easily washed away by the glacier streams, and even by the rain. The larger fragments and rocks which fall into the crevasses are ground to pieces before they again make their appearance in front of the glacier. From each of the arms of the glacier issues a stream, flowing in a distinctly marked bed, generally over fine sand and clayey matter, though occasionally over gravel. The second glacier arm that we passed possessed two emissaries, one flowing north, the other south, from the pass. Above and beyond these glacier arms we saw distinctly the flat conchoidal

*firn* basin, from which they proceed. Here and there black pinnacles and ridges of rock stick up through the great expanses of snow and ice. It seemed to me that with such weather as we were then experiencing the glaciers were growing actually bigger.



Fig. 373. LOOKING S 35° E FROM CAMP XL.

We saw herds of wild yaks in several directions, but all of them just at the lower margins of the glaciers; one big herd consisted almost entirely of cows and calves. We counted altogether over 300 head; evidently they are wont to gather in the summer from several directions up to these regions of perpetual snow, while in winter they break up into smaller companies. In these high altitudes they find their sustenance in moss, lichens, and short grass. As we drew near to them, they moved slowly off to yet higher regions. We also observed kulans and hares, but no antelopes or wild sheep.

The last part of the ascent up to the summit of the pass is rather steep, though it was the great attenuation of the atmosphere which made the climb appear more difficult and toilsome than it really was. The stream which we had hitherto followed had now come to an end, and we had also left behind us the last of the glaciers which go to feed it. The actual pass is as usual flat and greatly denuded, with soft rounded outlines. In fact it forms a slightly convex plateau from north to south and equally slightly concave from east to west. The surface consisted partly

of finely divided material, into which, as it was moist, our animals sank, and partly of moss — this where the ground was firmer — and partly also of coarse gravel and even larger pieces of stone. On the other hand there was no hard rock visible anywhere, except in close proximity to the glaciers; but the condition of our animals was such that a visit up to them was not to be thought of.

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## CHAPTER XXIX.

### CROSSING OVER THE GREAT NAMELESS RANGE — AN ICE-BOUND GLEN.

This pass reaches the respectable altitude of 5462 m., and is the highest I climbed over in the interior of the Tibetan highland; in fact, of all the passes that I have crossed over in Tibet it is the second highest, being exceeded only by the Kara-korum pass. We shall inquire later on what relation this range, on which we were then standing, bears to the Kara-korum range, as well as to the highest known ranges in eastern Tibet. For the present suffice it to observe, that this immense latitudinal swelling is possessed of no slight importance both geographically and ethnographically. In this respect it is like the Arka-tagh. Both ranges alike form ethnographical boundaries. No Tschan-to, as the Chinese call the Turkish race of East Turkestan, ever goes south of the Arka-tagh; while north of the Nameless range no Tibetan ever proceeds. It is only an occasional yak-hunter who journeys from the inhabited regions north and south of these two ranges over to the totally uninhabited country that intervenes between them. It is here then, in this intervening region, that we have the most inhospitable and the most inaccessible part of the Tibetan plateau, forming a broad zone that stretches right across the whole of Tibet from east to west. Neither of these ranges however forms a boundary for the self-contained drainage-basins: south of the Nameless range there exist innumerable such basins, including some of the most extensive and the most remarkable; while north of the Arka-tagh there also exist self-contained drainage-basins, though they are fewer in number. It is there however that we find the largest of all, namely Kum-köl, to say nothing of Tsajdam, though this really belongs to another category of Central Asian basin, and is rather cognate with the basin of the Tarim. There does however exist one important orographical difference between the two ranges, namely the absolute altitudes north of the Arka-tagh are in point of fact lower than the absolute altitudes on the plateau-land south of the same range; whereas in this respect scarce any difference can be detected between the uplands that extend north and south of the Nameless range. Thus the Arka-tagh constitutes a real boundary between two of the successive steps by which the Tibetan plateau is ascended; while the more southerly range merely forms a swelling of the plateau-

land itself, the relative altitudes of which are everywhere approximately the same. Yet we know too little about these two ranges to institute any general or definite comparisons between them. From what we do know about them, we may infer that the Arka-tagh possesses the more accentuated relief, a larger number of rocky peaks that still set denudation at defiance, and more extensive snow-fields and glaciers. The circumstance that the known passes of the Arka-tagh are lower than the pass which we have now reached may be of course purely fortuitous; for it would not be difficult to find in the former range passes which in all probability exceed an altitude of 5462 m., while on the other hand the Nameless range possibly possesses other passes which lie considerably lower than the figure just given. That a much greater quantity of snow should lie upon the peripheral ranges than upon the central ranges is self-evident. These last are screened from precipitation by the Himalayas and several other ranges to the north of them. The snow lies thicker upon even the Arka-tagh, owing to the fact that it is not screened by any other ranges to the north, even though it has, lying stretched out at its foot on that side, the arid lowlands of Central Asia. From our experiences of the days which I am now about to describe it will be seen that the country south of this lofty central range is visited by a more copious precipitation than the region to the north of it, though something also must be attributed to the fact that the rainy season was then approaching the maximum period of its incidence. We also observed that the country south of this same range is rather richer in vegetation than the region north of it, although at the same time the grass for several days southwards was distinguished by the usual niggardliness of Tibet. The faunal life too was rather greater on the same side of the range as compared with the country to the north of it. Still the wild yaks decreased rapidly in numbers as we approached the grazing-grounds of the Tibetan nomads; indeed it may be said that as a rule the wild yak occurs in greatest numbers on the loftiest swelling of the plateau, namely between the Arka-tagh and the great Nameless range.

The prospect southwards from the pass was not particularly encouraging. One might have expected to find there, as usual, one of the immense, broad, level latitudinal valleys which separate the mountain-ranges of Tibet. But instead of such, our eyes were met by a chaos of relatively small, low, rounded crests, including the spurs and ramifications of the main range. It soon turned out that we still had a good distance to travel, indeed not less than eleven days, before we reached relatively low regions, that is to say regions possessing the same altitude above sea-level as the summit of Mont Blanc! Immediately south of the pass stretches a highland basin, which lies in general 500 m. higher than the top of the highest mountain in Europe.

Our descent from the pass was very gentle, but we soon obtained a clue to the apparently confused relief relations by striking a brook, which showed us the most convenient way down between the ramifications of the range. This stream grew very rapidly bigger in proportion as it was joined by tributaries from both glacier areas. The country here was absolutely barren. The strenuous exertions which the caravan had just undergone rendered it imperative that we should halt as soon as ever we possibly could. Accordingly no sooner did the first blades of



*Lynette, A. B. Lagrelius & Westphal.*

LOOKING N. 14 W. N. 33 W. FROM CAMP XII.



grass, few and far between though they were, show themselves than we arranged Camp XLI, the altitude being 5375. Here we found a small herd of wild yaks and some mountain partridges. We were fortunate enough to cross this pass without the loss of a single animal, whereas when we crossed over the pass of the Arka-tagh we lost five camels, notwithstanding that the latter pass was 300 m. lower. This was in an essential degree due to the fact that my present caravan consisted exclusively of picked and proved veterans, while the animals which succumbed on the Arka-tagh pass were the feebler members of the caravan, moreover we had ascended from a far more favourable region than that which we left on the north side of the Nameless range. And then again the Arka-tagh was buried under snow and had steeper acclivities, while we had now for three days been climbing slowly and steadily towards higher regions. Although this camp was the highest we reached during this present expedition, no serious case of mountain sickness occurred amongst the men; though we had two men with us who had been unwell for a long time, and two of our hunters over-exerted themselves by pursuing wild yaks on foot.

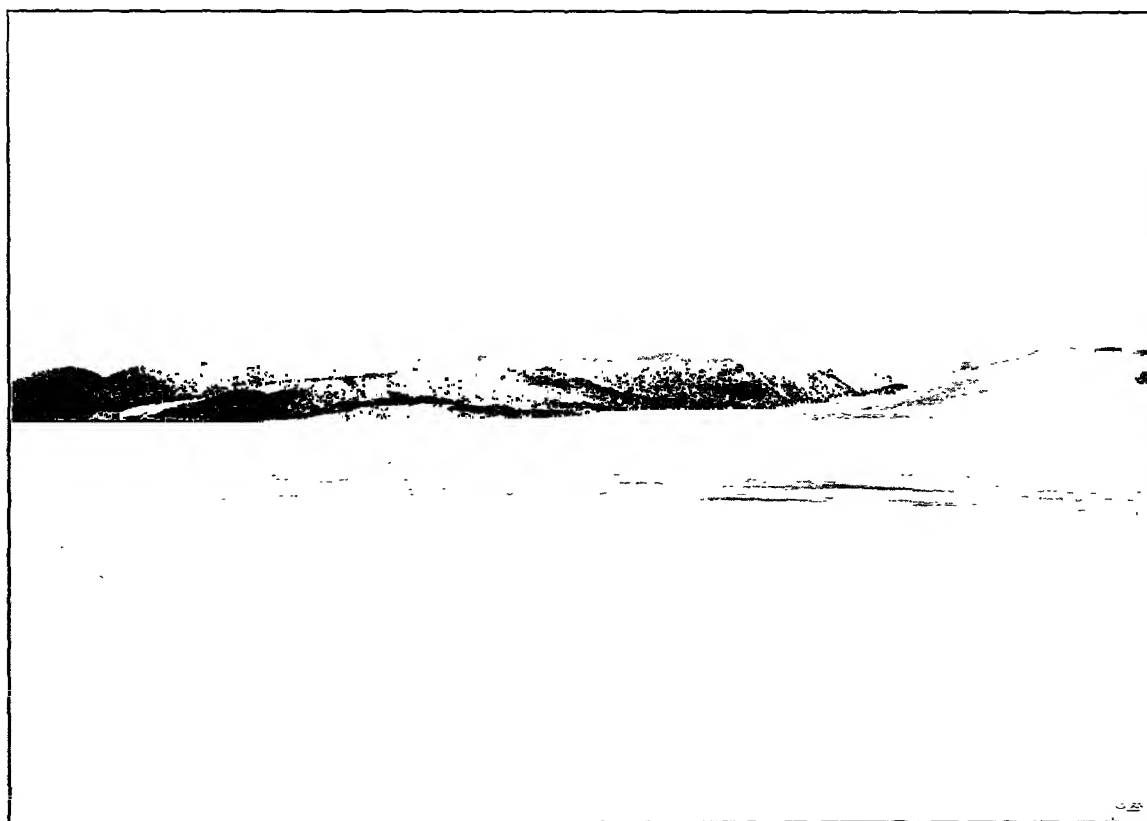


Fig. 374. LOOKING W FROM CAMP XLI.

Neither whilst crossing over the pass nor yet at the camp had I any opportunity to obtain a general view of the region of the *firns* and glaciers which rose to the east of our course. For on the morning of the 21st July we were greeted by a blinding snow-storm, though it failed to make the ground white, and then,

after it ceased snowing, the glaciers were enveloped in dense masses of black cloud, which seemed to sweep the ground. Three terminals of the eastern glacier stuck out however like the claws of a gigantic polar bear from underneath the lower hem of the clouds, but they too soon disappeared. The snow-line in this part of Tibet cannot run very much higher than the level of the pass. The pass itself was quite free from snow, a thing which only happens, I suppose, just at that season of the year, namely the end of July; though I suspect that even in winter the amount of snow is infinitesimal, not only because the precipitation is then insignificant, but also because the snow, being dry and powdery, is soon blown away, or else evaporates when the sky is clear. The snow however which fell on the 20th and 21st July melted the moment it came into contact with the ground, rendering it still more moist than it was before. Although the glaciers lie at such a steep pitch that one would expect them to descend rapidly, their arms do not reach down even as low as the pass (5462 m.); though one or two on the southern side of the range only stopped at elevations which fall short of the pass-altitude by ten or a dozen meters. The snow-line runs here at about 5600 m.

During the next day's march the weather was anything but favourable. Only a few minutes after we started a keen wind sprang up from the south-west and south-south-west, bringing with it a succession of hail-storms, often of great violence. After that it rained for the greater part of the day, but in the afternoon, when we began to draw near to our next camping-ground, it again turned to hail, and the shower was of such portentous violence that for a good hour we just had to stand still where we were; we were utterly unable to see where we were going to, for the moment we lifted up our heads, the hail-stones smote us in the face. Indeed it is impossible to make horses advance in the teeth of such a storm as that, they keep turning round and presenting their cruppers to the storm. At times it thundered and lightened, and the thunder was so violent that the ground almost seemed to shake under it, and we could not help fancying that we were at the very fountain-head and centre of the atmospherical disturbance. Yet neither here nor anywhere else in Tibet did I observe that the lightning actually struck the ground. The tempest did not however last very long, and we had a fine night.

The principal valley was now fairly open, and we continued to follow it downwards, sometimes along the foot of the hills on the left bank of the stream, sometimes in its gravelly bottom, along which flowed a brook of about 2 cub.m. in volume coming from the glaciers. It grew rapidly big as the day advanced and it was joined by an increasing number of tributaries, most of them from the left. The fall was regular and fairly gentle. The shape of the river-bed and the signs of erosion showed plainly, that it does at times carry considerable volumes of water. We continued to travel south until we reached the point where our stream joins a yet larger one coming from the west; the latter has its origin in the glacier-arms that lie west of the pass. After the confluence the united stream travels east, and then describes a curve towards the south-east, being apparently thrust out of its course by a range that bars its way. I assumed, that by following this stream downwards we should in due time readily reach a latitudinal valley containing a lake. It was in this expectation that we started to tramp down the valley or



THE ICE-SHEET ON THE RIGHT SIDE OF THE ICEBOUND GLEN.



*Lucretia A. B. Lagreene & Westphal.*

THE ICEBOUND GLEN. LOOKING NORTH.





rather glen, leaving a large ice-sheet on the right hand. A little bit farther down the whole of the glen floor, being level, was covered with similar sheets of ice; but the ice being rotten and rough on the surface, the camels were able to march without slipping, indeed they walked almost as securely as they do on sand. At first these ice-sheets were rather thin. Through the cracks and holes we saw the stream flowing on underneath, and I was amazed that such a thin crust was able to bear the weight of our camels. But lower down the ice was thicker, and we gradually found ourselves getting amid scenery that was as enchanting as it was interesting and uncommon. The ice-sheet upon which we were marching on the right side of the glen grew narrower and narrower, and finally stopped short, terminating in a blunted promontory. All the same the thickness did not decrease; but on the contrary the ice showed a steep front, as though it had suddenly broken off. The edges of the ice were at the best perpendicular, though generally they overhung and formed hollow arches, this being the result partly of the radiation of heat from the ground, partly of the erosive action of the water. At this point the ice was 1.97 m. thick. On the left side of the glen, there was another belt of ice of precisely the same thickness, and for as far as we could see down the glen it was unbroken, thus forming a peculiar and striking contrast to the dark ground and dark mountain-slopes. Between the two sheets of ice flowed the unfrozen river. As this glen now began to contract, it struck me that it was only a deep transverse glen through the range of foot-hills, and as I suspected it might prove troublesome and even a trying *cul-de-sac*, I resolved to send on a mounted scout to reconnoitre the road ahead. The next business was to get the camels and the rest of the caravan down from the top of the ice, for the prospect of retracing our steps all the way back on it was not attractive. Accordingly the men set to work with their axes and spades and chopped out a sloping path down to the bottom of the glen, and in order to prevent the animals from slipping they cut notches transversely across it and strewed it with sand. Meanwhile two of the men built up a high stone pyramid on the right-hand side of the glen, a fact which I again mention for the benefit of any European traveller who in the future may chance to stray to that remote spot. This »sign-post», unless in the meantime it gets destroyed by an avalanche of stones or by any other forcible change, will serve to warn him not to proceed any farther down that glen.

Meanwhile we got the caravan safely down to the bottom, which consisted in part of hard, tightly packed gravel, in part of treacherous mud and sand. The stream flung itself backwards and forwards from one side to the other, sometimes in one united volume, sometimes divided into several arms. The broken sheet of ice on the right side of the glen soon reappeared, while we, crossing over the river repeatedly, marched on between two walls of glittering solid ice. In one place, but one only, the entire stream disappeared underneath the ice on the right side of the glen; otherwise it kept strictly to the middle of the channel, though continually washing one or other of the icy walls. Of the two the one on the left, notwithstanding that it was more exposed to the sun, was the thicker. The whole of the way we went, it was continuous and broad, whereas the sheet or bench of ice on the opposite side was narrower and broken in several places; and through the gaps, which resembled more or less broad gateways, we were able to see the foot of the mountain-

slopes behind. The explanation of the difference is quite simply this, that the slopes on the right side of the glen are steeper than those on the left, while the river presses closer in to the former than to the latter, so that as a matter of fact there is less room there for the ice than on the left side, where the slopes are relatively less steep. Whereas no tributaries join the stream from the right, several do so from the left, all coming from the glacial mass on the east side of the pass. But on the whole the lower slopes on both sides are decidedly steep, and the glen bears every indication of an active and energetic erosion. Below the point where we turned back, the slopes on both sides are approximately equal in point of steepness, and it is there that the wild transverse glen begins to force its way through the mountains.

In this manner we slowly made our way down this picturesque and peculiar glen, although we were almost certain to get wet through, if not from the steadily falling rain, then from the river which we crossed time after time, or finally from the dripping of the ice-eaves, close under which we were sometimes forced to march. The breadth of the open space between the two icy walls varied of course as the breadth of the glen varied; at the maximum it reached about 40 m., at the minimum half that distance. At length we met our scout coming back. He said he had been about 5 km. farther, but was then stopped, the glen being absolutely impassable. From his description it was evident, that the farther he proceeded the narrower grew the glen, while the ice-bench continued the whole way, although broken in several places, especially at the narrow passages. Nowhere did the glen open out, nor did he observe the slightest signs of grass on the glen-sides. At the point where he stopped the glen was so narrow that the stream, a mere deep trough, filled it completely from side to side. In spite of this he attempted to force a passage through, but when he got out into water 1 m. deep, and the depth still seemed to increase, he thought it better to turn back, especially as the glen farther on grew yet wilder and assumed an increasingly closer resemblance to a typical transverse gorge. As the stream moreover had risen higher and higher during the course of the day, I felt it would clearly be a risky thing to push on any farther. We might indeed succeed in forcing our way past one or two of the difficult passages, but sooner or later we should find ourselves in a trap, and unable either to advance or even to return, should the river still go on rising behind us. It might indeed have been possible to climb up some side-glen in search of a pass, and in that way continue our route to the south, — possible that is for the horses and mules, but absolutely impossible for the camels.

Hence we had no alternative except to return by the way we had come, and accordingly we retraced our footsteps, every one of which was now filled with bright, blue-green water. Owing to the trampling of our caravan animals, all the soft places were yet softer than they had been before, and to add to our difficulties, we had now to climb uphill.

Some idea of the dimensions and appearance of these immense ice-sheets is given by the accompanying photographs. The ice, which now filled two-thirds of the glen-bottom, was formed in the autumn and winter, partly by the freezing of thaw-water from the glaciers and snow (though this must be little), for they will continue to melt especially on bright, still days, and partly, and more particularly,



MAKING A PATH DOWN TO THE BOTTOM OF THE GLEN.



*Ljustr. A. B. Lagrelius & Westphal.*

THE FRONT OF THE ICE-SHEET ON THE RIGHT SIDE OF THE GLEN.



by the freezing of water from perennial springs, which, likewise derived from the perpetual snows, gush out at numberless places in the bottom of the glen. These waters freeze in the cold, shaded glen in successive layers one upon the other, the bedding being very distinct and recognisable in the broken vertical faces of the ice-bench. On the top of all was what was evidently a phenomenon of secondary regelation, and connected with rainfall and wind, namely a layer of thin ice-needles and laminae set vertically on edge, all about 5 cm. high, quite easy to see from the side, though when looked at from above they had all the appearance of green velvet. This however made the surface of the ice yielding and easy to march on, the ice crystals crackling and crunching underfoot like snow. Under that topmost layer came several others of varying consistency and colour, some being hard and bright as glass, while others were crowded with air-bubbles, making them white like snow. These kinds of layers alternated several times. It looked as though the hard layers were formed by the freezing of actually running water, while the white layers owed their origin to copious falls of snow, which had been compressed and consolidated by the next irruption of spring-water.

The accompanying illustration (fig. 376) shows a transverse section of the glen at a narrow part. The edges of the ice-bench form, as will be seen, almost everywhere overhanging eaves, so that the upper area of the ice is always greater than its basal area. In some places, especially at the foot of the mountains on the right side of the glen, spacious caves and grottoes were hollowed out underneath the projecting icy roof; this was often very thin, and terminated in an edge as sharp as a knife. This construction is caused by two factors — on the side next the glen-slopes by their radiation and on the side next the stream by the beating and friction of the water against the ice. The thaw-water dripped and ran down off the projecting edges, and with the rain-water to help it formed innumerable tiny cascades, which splashed and sprinkled in every direction. These tiny rivulets gradually find their way into the river, this being one of the causes of the stream's constant augmentation farther down; at the

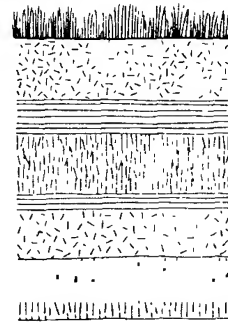


Fig. 375.

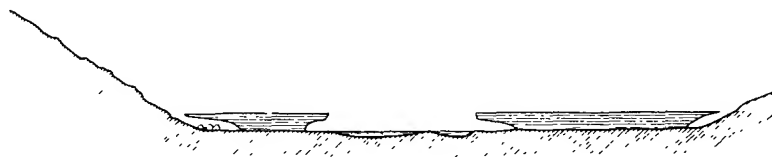


Fig. 376.

point where we turned back the volume would be about 8 cub.m. in the second. On the surface of the ice I observed countless miniature pools and rills, running together and forming complete hydrographical systems. Suppose we cross over one of these rivulets: it is not more than a foot broad and half a foot deep; its bed consists of ice as clear as glass, gleaming light green against the white slush

that surrounds it. After running about a score of meters, the little stream empties itself into a pool, the water in which glistens with the same fresh and glorious tints as the foliage of the young birches in spring. Then, passing out of the pool at its other end, the streamlet, after traversing yet a second pool, pours itself in a foaming cascade over the brink of the ice, and so seeks the river below. On every side we heard the splashing of these tiny waterfalls, and our ears were filled with their never-ceasing murmur. The ice was thawing rapidly and without ceasing, being attacked as it was at one and the same time by the relative mildness of the summer airs, the rain, and the river. Often the entire glen would echo again and again, as an overhanging eave, eaten through by one of these insidious little streamlets, broke off and tumbled down *en bloc*. And in those parts where the river did not directly brush against the face of the ice big pieces of it, which had in this way snapped off, were heaped up together. But when they fell into shallow water, they were soon destroyed, and when they dropped into deep water, they were quickly swept away by the current.

In consequence of this lively activity, it would be fair to suppose that the bench of ice which we saw on the 21st July would, during what remained of the summer, that is by the end of September, diminish very considerably in extent. It is however in the highest degree unlikely that this solid bank of 2 m. of ice, indeed lower down it was even 3 m. thick, is built up in the course of a single winter; it is rather the result of several winters' frosts. I infer therefore that even in September a very considerable portion of the ice would remain, more especially those parts on the right side of the glen which are almost constantly in the shade. When the river freezes in the autumn and becomes entirely ice-bound, and fresh layers of descending water freeze on the top of the first ice-sheet. — when in a word the bottom of the glen is during the cold season again filled with its own ice, those portions of the ice-bench that still survive become gradually entombed in the new ice-sheet, and so form an integral part of it; and when at length the newly formed ice reaches the same level and the same thickness as the old ice, then, but not until then, does the last-named increase in thickness and in height, and finally the whole forms one single connected, compact mass. During the whole of the winter this mass will go on growing constantly bigger, and will not reach its maximum until well on in the spring, when the amount that freezes during the night is melted again during the following day. After that the thaw will gradually win the upper hand, the glacier stream will gather strength daily, and begin to attack the middle of the ice-sheet both from above and from below, until at last it forces a free passage through it. That accomplished, the stream will flow on between its long walls of ice, which go on decreasing all summer in the way I have described.

I have no doubt that in the autumn, when the ice has still further decreased in extent, and when the volume of the glacier-stream has seriously shrunk, it would be possible to travel down this glen; possibly also it could be done in the winter, when one could march the whole way on the ice. With regard to the volume of the glacier-stream, it varies of course, not only during the course of the 24 hours, but also from day to day. On the 21st July it was clearly much smaller than it *can* be during the summer, for the water was virtually clear; whereas, seeing that



HALT ON THE TOP OF THE ICE.



*Lieut. A. S. Ligre's & Westphal*

MAKING A PATH DOWN FROM THE ICE: IN THE BACKGROUND THE LEFTSIDE-FRIDGE OF ICE.





it issues from glaciers, it ought to have been charged with fine detritus, i. e. glacial mud. At that date therefore the river consisted almost entirely of spring-water, together with water from the melting of the ice in the glen. The extremely slight admixture of sediment which the water did carry with it proved that a small proportion of it did originate from the glaciers. It was of course the weather that was responsible for the insignificant yield of these glacier-streams, height of summer though it was. The dense masses of cloud in which the *firn* and glacier region were then enveloped completely neutralised the effects of the sun and prevented all thawing, while such precipitation as they did discharge over that area took exclusively the shape of hail and snow.

In a sense this glen-ice might almost be regarded as a regenerated glacier, though with an intervening stage in which it assumes the form of running thaw-water. Like the glaciers of the *firn* region, it preserves year after year approximately the same dimensions, the oscillations being but slight. A permanently increasing accumulation of ice in the glen cannot take place owing to its mass being modified by the summer thaws, when the water, which has been arrested and held up during the winter, is again able to continue its course unchecked down to the salt lake in which it finally empties. We found an exactly similar phenomenon of regenerated ice on the northern side of this same range, in the vicinity of Camps XL and XXXIX, though the ice-sheets there were infinitesimally small as compared with those on the southern side of the range. Yet on neither side of the range was I able to observe any traces of a former wider extension of the existing glaciers: neither moraines nor erratic blocks were to be discovered, and there could not of course be glacial scratches in a country where hard rock is a rarity.

However, we turned back, as I have said, up the glen and proceeded as far as the point where the glen with the pass unites with the main stream, and from there we made our way up a minor side-glen towards the south-west. It was now quite evident that we were not to get out of this highland basin except at the cost of crossing over yet another pass. The surface was for the most part barren; although at Camp XLII, at an altitude of 5268 m., we did find a few scattered blades of grass growing.

During this day's march we observed hard rock at four places, namely varieties of hard, fine-grained, crystalline schists, dipping  $10^{\circ}$  towards the N.  $57^{\circ}$  W.,  $60^{\circ}$  towards the S.  $70^{\circ}$  W.,  $20^{\circ}$  towards the N.  $60^{\circ}$  W., and  $15^{\circ}$  towards the N.  $20^{\circ}$  W. Generally however these species of rock were pretty severely weathered on the surface.

Thus Camp XLII was situated in the great broad gathering-basin, in which all the rain-water and thaw-water are collected that find their way down into the ice-filled transverse glen. Three converging streams in particular are to be noted — that which flows due south from the main pass, on the left bank of which we marched; a middle one, the biggest of the three, coming from the west, where it probably gathers up a whole series of smaller brooks that stream down off the glaciers south-west of the pass; and a third, which comes from the south-south-west, that is to

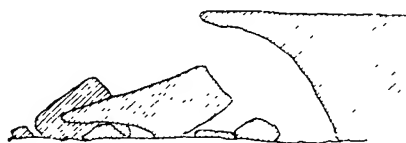


Fig. 377. VERTICAL SECTION OF ICE-EDGE.

say from the pass which we now had to cross over, namely the pass situated in the subsidiary range that is pierced by the united stream. This pass proved to be the most difficult of any that I have ever scaled in Tibet, not by reason of its altitude, for it was 100 m. lower than the principal pass and only 100 m. higher than Camp XLII, but because of the character of the ground and the weather that prevailed. At a very early hour in the morning it was snowing smartly, and the mountains were so closely wrapped about with clouds that we might easily have fancied ourselves engulfed by a Polar night. Unfortunately not one single glimpse of the glaciers was to be seen, so that I was unable to secure a much-needed general view of this stupendous range of mountains, nor did I get any opportunity to take the compass-bearings of the peaks and glaciers the situations of which I had already noted from the other side. Upon reaching the summit of the pass we found ourselves in the centre of one of the most furious hailstorms it has ever been my lot to experience. It utterly exhausted us, it numbed us, it made us drowsy, our faculties for work sank to the lowest ebb. And the downfall continued the whole of the day with only one half hour's interval, though it mostly assumed the form of snow and rain. Before we had proceeded very far we were thoroughly wet through, and the increase of weight thus occasioned in our baggage added yet further to our difficulties.

The *thalweg* which leads up to the pass is extremely flat, appearing merely as a very slight indentation of the slope, surrounded by soft, rounded outliers. Thus, at any rate at first, the ascent was as gentle as could be; but just before reaching the pass, we were well sensible of it. Down the middle of the glen, though there was no distinctly eroded watercourse, flowed a trickling rivulet. We had to ride in the water, that being the only place where the ground would bear the weight of our horses and camels; to leave it for a couple of meters, or even for one meter, was to run the risk of being swallowed up in the boggy and treacherous morass. Nowhere was hard rock visible, nothing but sand, powdery earth, and water, the whole forming a thick porridge-like mass, which was evidently slipping or gliding downwards *en masse*. Of course we did not actually *see* the mass in movement, for it moves inconceivably slowly; but that the mass really was in movement was quite evident from the vast number of marginal and transverse cracks showing all over the slopes, except in those places where they were held together by moss and thin yak-grass. To have ventured out amongst these cracks, or rather fissures, would have been perilous, for they formed dark lines, convex downwards, with ramparts between. The only places in which the ground was firm enough to bear were the actual watercourses and the occasional spots where moss grew. The more this spongy mass becomes soaked with rain and other precipitation, the more readily it moves and the boggier it grows. That period of the year was therefore the least favourable of any for crossing over such a pass; the only time at which one might hope to traverse it without especial difficulty would be in the winter, for then the whole of the surface would be frozen, covered as it were with a coating of frozen ground which would check the descending movement of the boggy coverlet. It is of course only natural that a range, which is so deficient in hard rock as this is, and in which moreover denudation has advanced so far, should be flat and compressed; it is even pres-



THE INNER EDGE OF THE ICE.



*Ljustr A. B. Lagrellius & Westphal.*

MAKING THE ROAD.



sed down by its own weight. The reason that the procedure has not advanced so far as to make the range to all intents and purposes level must be, not only that it possesses a skeleton of hard rock, though this is for the most part invisible, but also that the erosive energy is never at rest.

In spite of this abominable ground — and its difficulties were still further intensified by the continuous downfall, which gave rise to tiny rivulets and rills in every hollow — the antelopes exhibited no hesitation to remain there, for we saw several large herds in the vicinity. Of wild yaks and kulans we observed nothing except their tracks and droppings, and these evidently belonged to a season when the ground was firmer than it was just then.

The pass formed a very slight notch in the crest, or rather it formed a flat arch, for we preferred to keep to the side of the actual pass: on it we should inevitably have perished in the mire. On this saddle, which reaches an altitude of 5367 m., the only outstanding feature is a small insignificant ridge of hard rock, its strike running from S. 38° W. to N. 38° E., with a vertical dip; it consisted of the same fine-grained crystalline schist as that which we came across on the preceding day's march. A little way down the southern glen we observed a hard porphyry-like rock with a dip of 33° towards the S. Although these passes form the culminating points on the meridional line by which we crossed the Tibetan highland, hard rock was nevertheless remarkably rare. It is true, there were rocky crags on both sides of the pass; but when you are 550 and 650 m. above the altitude of Mont Blanc, and have for months been travelling at elevations that exceed the elevation of Mont Blanc, both men and animals become so wearied that you are only too glad to avoid all extra excursions.

The glimpses which we obtained from this pass through the rain and hail, and through chance rifts in the clouds, were anything but encouraging. There was, for one thing, not the slightest indication of a latitudinal valley. We saw nothing but a world of mountains — a region which was in fact in a far higher degree a highland region than a plateau-land. In the south-west, beyond the rounded crests, free from snow, that were nearest to us, rose higher mountain-masses, covered with snow, which had evidently fallen during the last few days. Usually it was with a feeling of satisfaction and pleasure that we began our descent from these lofty ranges; but from this pass the downward march was anything but agreeable. The southern slope of the range was much worse than the northern. Probably the precipitation is in general more abundant on the former; at all events it was so that day. The consequence was, that the ground was more saturated and softer than it was on the northern side. If anybody should think that my words are exaggerated when I say, that there was a risk of being engulfed in the mire, I may state that just below this very pass we lost one of the best of our camels, the poor beast having literally sunk so deep into the quagmire that it was impossible to save him. Accordingly we left him behind with a couple of men to look after him, in the hope that next morning, when the ground had frozen, we might be able to rescue him; but during the night he sank in still deeper and became entirely lost. It cannot be more dangerous to sail through unknown waters where shallows and sunken rocks abound than it is to travel in such a country. A couple of men went on first to

see where the ground would best bear the weight of the caravan. Next after them followed the horses and mules; but even when the ground was firm enough to bear these animals, it gave way underneath the slow and heavy camels. Hence each camel had to be supported by two men on each side, who hurried the beast on as fast as possible. The results of my excursions in Tibet go to show that attempts to travel across the high plateaus in summer should be avoided. The reason for choosing that season is the hope of finding grazing for the caravan animals, but nothing is gained by that. The difficulties of the ground tax the animals' strength far more than the want of grazing, so that it is wiser to do as Bonvalot and Dutreuil de Rhins did, and travel in the winter; by so doing you gain time and advance more quickly across the barren parts of the highlands. During the course of my winter journey through western Tibet I never once had to contend against this kind of difficulty, although a caravan has then difficulties of another character to struggle against, especially the persistent westerly winds. However, once you have traversed the plateau region between the Arka-tagh and the Nameless Range, and have started to travel south from this latter, the country improves gradually, the reason being that the grass slowly becomes more and more abundant. However it is hardly possible to lay down any general rules for the regional distribution of the boggy ground. It does indeed seem to be the rule that the finest sifted disintegrated material fills the concave self-contained basins, and that hard rock is most abundant in the mountain-ranges which border these basins, but generally it is just the flat, barren, denuded summits of the ranges that possess a greater proportion of boggy ground than the horizontal latitudinal valleys. In these latter the fine material, as a direct consequence of the hollowness of the cavity, is more closely consolidated than on the convex heights; while these again are exposed to a more copious downfall, so that the fine material, instead of being there more tightly packed together, is more and more loosened after each successive shower, and consequently more and more inclined to glide downwards on both sides. Nevertheless it very often happens that such a crest is hard and firm, especially if it is grass-grown, while on the other hand the bottom of a latitudinal valley may be soft and marshy where it is barren and sufficiently sodden. Again, crests in which the sifting distributive work of denudation is not yet completely finished, so that they still consist to a very considerable extent of gravel, may also be hard and firm enough to bear. In the boggy regions, no matter whether situated in the valleys or on the heights, the only routes that are at all practicable are the bottoms of the watercourses.

This was the case now when we started to go down from the difficult pass; we had to travel the whole of the way in the bed of the brook which gurgled down the glen, and the farther we descended the better grew its gravel-filled channel. The brook finally ran into a main stream flowing towards the south-east and carrying at that moment a volume of about 4 cub.m. in the second. This latter was divided into several arms, distributed throughout its broad and deeply excavated bed. Here, so long as we rode in the water or in a bed of the stream which had quite recently carried water, the going was excellent; but outside of these the ground was again boggy. The tracks of the yaks and kulans served as warnings to us, particularly when we saw them growing deeper and zigzagging in black dotted lines.

On the slopes above the river on the right we detected distinct indications of a path that was not made by either kulans or wild yaks, but by Tibetans. We had fancied we saw signs of paths two or three times on the southern side of the principal pass, though it was difficult to make out with certainty whether they were made by wild animals or by tame ones. We now came across an earthenware cooking-pot with two ears and a strip of skin wound round its short neck (fig. 378); it had no doubt been left behind by yak-hunters in one of their annual halts in that locality. Camp XLIII was pitched in the bed of the stream at an altitude of 5146 m. In all the circumjacent mountains there was not a single specimen of hard rock within sight: they all consisted of reddish-brown finely pulverised material and sand, then beaten upon by the pouring rain, though only a short time before the valley had been shrouded in an impenetrable fall of blinding snow. The slopes were practically barren, only very small patches of grass growing in sheltered hollows.

On 24th July we only did 2.7 km. down the valley, for we then reached a locality in which our scouts had discovered excellent grazing. In the second half of this short stretch the fall was so great that the river formed several cascades in its gravelly bed, down to which the hills on both sides descended steeply. Even there the grass began to be good in quality, though not particularly abundant, except in the glens that are protected on the north, but open to the south; there however it was thicker. But it steadily improved as we proceeded, until in the locality where we encamped it was better than any we had come across since leaving the Astin-tagh. The glen is very narrow, and the stream winds backwards and forwards in it unceasingly. It might have been feared that this glen too would resolve itself into a transverse gorge of the same appearance and character as the ice-filled glen which we had recently attempted to penetrate. But not so: it turned out, that we had at length found a way out of these inaccessible mountainous regions. We pitched our tents, Camp XLIV, at an altitude of 5127 m., on a flat hill on the left side of the stream, the site being about a score of meters higher than the bottom of the glen. All around was a chaos of ridges and rounded peaks. We saw hares, ravens, and kulans. During the two days' rest that we granted ourselves in this singularly pleasing neighbourhood, we enjoyed splendid weather, a break in the incessant downfall which had prevailed during the preceding days. Possibly the change was brought about by the north-east wind which seemed to predominate there. What rain did fall was quite insignificant in quantity, and for the most part the sky was perfectly clear. From that position we were unable to see the glaciated range, and down the glen too it was impossible to see far, owing to its being so deeply sunk.

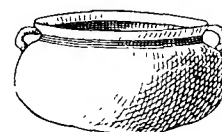


Fig. 378.

The volume of the river varied very considerably during the course of the day and night. When we measured it on the morning of the 26th July, it was only 1.2 cub.m. in the second (mean depth, 0.32 m.; mean velocity, 0.68 m.; and breadth, 5.5 m.); but towards evening its volume grew many times bigger and at the same time the water became very muddy, as it boiled along with a deep, hollow rumble at the bottom of the glen.





# THE DASH FOR LHASA.



## CHAPTER XXX.

### ACROSS THE SATSCHU-TSANGPO AND BACK AGAIN.

Camp XLIV was for a time an important point in our journey, in that I selected it as the base from which to make an attempt to penetrate as far south as possible, as far as Lhasa if it could be done. The story of that attempt I have written in my more popular book, and accordingly I need not dwell upon it further here. All I will now say is, that the journey was carried out under exceptionally difficult circumstances: in addition to the hindrances placed in our way by the ground and the weather, we had also to keep a perpetual watch against men, for sooner or later, judging by the difficulties that other travellers had encountered who had attempted to penetrate to Lhasa, we knew we should be forcibly turned back. The circumstance that, during the nine days I travelled towards the south-east, I travelled in disguise, and was obliged to preserve my incognito, interfered to a great extent with the geographical and topographical results of the journey. In point of accuracy and general value the observations which I made during this excursion cannot therefore be compared with the results obtained under normal circumstances. And this is more especially true of the tracts inhabited by the nomads, where the taking of observations would infallibly have aroused their suspicion and guided it in the right direction. In consequence of this my notes were brief, and were only jotted down under conditions of the utmost secrecy. But as they fill up, however imperfectly, a gap in our knowledge of the country, I will reproduce them here. It is only during the last few days of this trip that my route coincides in part with Bonvalot's, but my sketch-map is more detailed than his. By way of instruments I took only such as were absolutely indispensable, and such as could easily be concealed — watch, compass, aneroids, thermometers, and writing-materials.

We started on 27th July, travelling down the narrow, winding glen, between the steep, abrupt hills that shut it in. By that the river had swollen considerably in volume. It keeps for the most part to one inclusive channel, with steep terraced banks, which at the bends especially become high and vertical; though lower down in various expansions of the glen the river is divided into several arms. Soon after starting, we forded the stream nine times, and then kept for some distance to the slopes on its left side, though this compelled us to cross over several deeply trenched

contributories, some of which contained water, derived from springs in the vicinity. On the other hand there was no water in any of the side-glens which came down from the right; but then the mountain-spur on that side exhibited no traces of snow. The predominant colour of the scenery was red, red sandstone and red conglomerate predominating. The dip appeared on the whole to be about  $25^{\circ}$  towards the SSE. As a rule the prevailing formation was soft, finely sifted material, though gravel and small fragments of rock also occurred. The grass here was not so good as at Camp XLIV, being luxuriant only in the side-glens that contained water. The tracts around the mouths of three small brooks were in especial green with grass, and there we saw signs of Tibetan encampments. Several yak skulls, and the entire skeleton of a yak, tolerably fresh, bore witness to the fact that the locality was visited by hunters; traces of a bear were also found. We looked, but looked in vain, for some low pass across the spur on the south, and consequently had to keep following on down the glen; and indeed it soon appeared that this was the only right road. In two or three places cairns of stones were built up to indicate where the fords cross the river. From this I infer that the river sometimes swells to such an extent that it can only be forded at certain places; but at the best the high flood will only last one or two days. The bottom of the glen is full of gravel, and in some places is marshy and treacherous. Hence we left it and preferred to travel on the slopes, although in consequence of the innumerable gullies it was weary work. At intervals in the lower part of the glen there were open basins of spring-water. At length we crossed over the last of the great windings of the river, the mountains receded, and our glen debouched upon an immense open space, a plain entirely encircled by mountains, though it was the most open towards the east and south-east. On the north was the great range in which is the pass surrounded by glaciers. From our present position it was less impressive in appearance, partly because the glen in which we were was higher than the latitudinal valley on the north side of the range and partly because the amount of snow is far less on the south side of the summit than on the north.

Directly we emerged from the glen we turned our faces towards the south-east and crossed the plain diagonally; the river, keeping to the north, soon became lost to sight. So far as it was possible to follow its course, it appeared to be directed to the N.  $52^{\circ}$  E., and in the E.N.E. we observed the entrance to the broad latitudinal valley through which the lower part of the river flows. Where it goes to I was unable to make out either on that occasion or subsequently; probably it describes a curve towards the east and south-east, and enters a salt lake which we came to a day's journey farther on. Farther on too there rises on the right or southern bank of the river a low and inconspicuous range which shuts in the plain on the east. On the north the river is however bounded by the great mountain-range, with its ramifications and offshoots, pierced at intervals by glens, and containing streams which descend from the main range and manifestly enter our river.

On the south of the plain there are likewise relatively low mountains, with a couple of gaps or breaches to the south-west, no doubt the entrances of glens which run parallel to the east-west main valley, or even simply form part of it. The surface of the plain had dried since the last downfall, and was hard and excellent,

without any boggy, water-logged marshes. To glance at, it was perfectly level, but in reality it slopes slowly down towards the north-east, and is scored by three shallow watercourses, then devoid of water, and all directed towards the principal river. One of them however entered a little pool in which some water still remained. The grazing was very poor; nevertheless we saw yaks and kulans, and even a solitary wolf. On the other hand marmots and hares, which were plentiful in the glen that we had just left behind us, were now absent. At length we reached a broad, flat glen in which were a couple of basins containing gloriously bright spring-water. The grazing was of moderate quality; but there was any quantity of yak-droppings. Camp XLV had an altitude of 5028 m. From this point the loftiest peaks visible in the great main range towered up in the N. 30° W. and N. 5° E.

July 28th. The surface rose imperceptibly, at least to the eye, towards the east-south-east, until it reached a flat saddle, though it was impossible to make out which was the real culminating point. In the southern part of the glen there was however a watercourse, which higher up contained some spring-water and pools in two or three places; and there were other pools, but disconnected, on the north side of the glen. We pitched Camp XLV near the point where the watercourse just mentioned turns to the north. Grass was very sparse; frequently indeed there was none, though there were garlic and rhubarb. Of human beings we saw not the slightest trace, while the wild animals in this locality were so little shy and so numerous that, I concluded, we were still a long way from the first of the nomads. Yaks and kulans were visible in several directions, as also one orongo antelope, a vast number of hares, an occasional marmot sitting beside its burrow, and ravens. The surface of the ground was literally chequered with their tracks leading in all directions. From the top of the flat pass, which was entirely a secondary water-divide, we perceived to the east a gigantic snowy mountain with a blue lake at its western foot, and stretching in the direction in which we were going, namely east-south-east. On the way we crossed over a series of dry watercourses, which come down from a rather low ridge on the south and enter the principal watercourse, that runs down from the pass towards the lake just alluded to. Upon drawing nearer to this last we perceived that the eastern arm of the minor range, which is built up of red sandstone, plunges vertically down into the lake without leaving so much as the narrowest pathway alongside the water. Consequently we were forced to make a detour to the south-west, and to cross over the range by a pass which, although it was only 100 m. above the level of the lake, was nevertheless rather toilsome. After that we followed the curve of the southern shore, the ground consisting of barren detritus. In places there were shore lagoons, one of them being of pretty fair size. The water was intensely salt, and, so far as we were able to see, without a sign of either animal or vegetable life. Along that same shore, which forms a curve so regular as almost to have been drawn with a pair of compasses, run three old strand-ramparts, quite close together and at a distance of 300 m. from the existing shoreline. The beach was flat, and the highest of the old circular marks was not, I dare say, more than 6 m. above the existing level of the lake. These old strand-ramparts also are regularly formed, running for the most part parallel with the shore; but in places they are broken, and at length they stop entirely at the narrow isthmus which

parts the lake from a large fresh-water pool to the south of it. It was here we encamped. This isthmus was even less than 6 m. above the level of the lake. The reason that the pool, although so close to the lake, possessed fresh water, was that it no doubt communicates with it by an underground effluent. Had we had time to follow the outline of the shore, we should doubtless have found that it sweeps round to the south in the way it does in order to avoid the flat tract which exists there and its then disconnected pools. At all events the strand-ramparts prove that the lake was formerly far bigger than it is now, and that it is consequently undergoing a process of desiccation.

Camp XLVI was situated at an altitude of 4972 m., one or two meters higher than the lake. The grazing here was poor. On the shore we came across an old encampment. But an even still clearer proof that Tibetans do occasionally visit that region was afforded by an attack made upon us the next night by horse-thieves, who retired towards the south or south-west.

On the 29th July we travelled almost all day towards the S.  $70^{\circ}$  E., the ground being exceptionally favourable owing to the wonderfully slight differences of elevation. At first our route ran between the fresh-water pool on our left and some shallow salt-water pools on our right. We now came upon sheep-droppings in extraordinary quantity in one or two places. From this I was at first led to think that the nomads must extend their wanderings thus far north. But later on I learned that the people use caravans of sheep for the purpose of fetching salt from salt-pans that lie to the north of the inhabited regions, and the indications we found were no doubt left by some such caravan. After that we ascended a broad valley, the watercourse in which was moist and contained a couple of pools; this water would eventually make its way down to the salt pools which I have mentioned. Here the grazing was excellent, and there were hosts of wild animals — kulans and antelopes, while on the slope of the relatively low hills to the south was an immense herd of wild yaks, with a great many calves. Farther on partridges abounded.

The pass up to which the glen leads has an altitude of 5003 m. From its summit we saw a great, broad, open latitudinal valley stretching from east-north-east to west-south-west. All the watercourses and glens of the region converge upon a depression lying to the south-west; probably there is a salt lake there. Having crossed over this glen towards the east-south-east, we directed our march towards the lowest notch that we could see in the range to the south, which however was not very high, the surface rising slowly as we advanced. We crossed over a number of eroded watercourses and occasionally a pool. The grazing was excellent, and in places there was dry scrub. We pitched our tent (Camp XLVII) beside a little brook at an altitude of 5117 m. There was here any amount of wild-yak droppings. We saw in the far distance three mounted Tibetans, who however disappeared towards the north-west.

During the last few days the precipitation had been quite insignificant. This day the weather continued brilliant until the afternoon, in fact it was sometimes uncomfortably warm; but during the latter half of the day's march we were inconvenienced by heavy rain, with a strong gale of wind from the south-east. When darkness fell, the sky was everywhere hidden behind louring clouds, while the light-

ning played and the thunder was ear-splitting. At 9 30 p.m. there burst one of the most violent tempests I have ever witnessed, the wind being then in the north-west. The rain literally poured down in torrents, and spouted up again from the ground. In consequence of this the surface was once more softened. The tempest continued all night. The downfall which we had hitherto experienced, and which I have attributed to the beginning of the rainy season, was a mere trifle in comparison with that which now came. The few days of fine weather that we had enjoyed were merely an interlude; the experience of the days that succeeded taught us that the rainy season *par excellence* in Central and Southern Tibet falls in the late summer.

July 30th. In the morning the sky still continued to wear an ominous look, sheeted as it was with the most threatening clouds, from which hung heavy fringes charged with rain and snow. So long as we were in the saddle, however, we were spared a wetting, except that in the glen, just below the highest pass, it hailed and rained for about half an hour. The mountain-range to the south was whitened over with snow. The last storm had softened the ground a good deal, and it was everywhere saturated, in some places actually boggy. All the watercourses contained running streams.

At first the ascent towards the foot of the mountain was gentle, but it grew more pronounced after we struck into the glen that leads up to the pass. From the mountains on our right several small brooks descend towards the north-west, though later they probably incline towards the west. This glen was deep and narrow, and its boggy ground treacherous and tiring. Here and there the hard rock cropped out in the form of red sandstone, greatly weathered, and with a dip of  $12^{\circ}$  towards the N.  $15^{\circ}$  W. So far as we could see for the snow, all the heights around were reddened with the disintegrated products of the same rock. The bottom of the brook that flows down the glen was, contrary to rule, just as soft as the circumjacent hills, and it contained but little gravel. We passed a cairn of stones and an old fireplace. When at length the acclivity grew too steep, we struck in amongst the hills at the side, and in that way reached the arched pass, which has an altitude of 5246 m. Thus the country showed no decided tendency to become lower.

On the southern side of the pass the descent was at first steep, but it soon changed into a gentle declivity going down a broad, open glen towards the south-east. But as it swung away too abruptly to the south and south-south-west, breaking through a minor range, we left it on our right and made our way up to another pass in the same secondary range, being induced to do this more particularly by finding there a well-used track. In the glen between the two passes the grazing was good, and here we came across numerous camp-fires, old and new; some of the latter may have been used only five days before. Here also lay a dead sheep, together with its load of salt, sewn up in sacking. At several of these old encampments there were bones of yaks. Yak-dung was particularly plentiful, though this was unquestionably from tame yaks. Further a whole herd of yaks appeared to have been recently driven from that locality towards the north or north-east. All these indications were the results of the visits of nomads, who during the warm season drive their herds of yaks up towards those parts of the central highlands that supply sufficient grass to feed their animals.

In the glen there were several springs of clear water, some with, others without, open basins. We climbed up to the second pass by means of a stony, tiring brae. The pass, which is only 40 m. higher than the bottom of the glen, is crowned by a cairn of stones. Then, after crossing over a little shallow valley, we came to yet another pass. Properly speaking it was a double pass, the northern division of it being the higher (5123 m.). The view was not particularly extensive: all we could see was a chaos of mountains to the south and south-east, while to the east-south-east were lofty snowy peaks. From the pass we descended abruptly into a glen that contained a great number of marshes, pools, springs, and brooks, as also luxuriant grass. The surface was soft, though the slopes here and there were strewn with gravel and chips of sandstone. Here again there was a great quantity of yak-dung, as well as marks of encampments, where the nomads had stayed one or two days in the course of their wanderings; but we saw no signs of any longer visits. But from the cakes of yak-dung being in several places turned over, so as to dry better, it was evident that the nomads intended to return. We made Camp XLVIII, at an altitude of 5036 m., on the narrow isthmus, 70 m. across, between two pools of water.



Fig. 378. TIBETAN TYPES.

At five o'clock it again began to rain fast, and so continued all night. Only once before do I remember to have seen it rain so violently and so fast, and that was at Asterabad on the Caspian in Persia.

On 31st July we had a long ride of 42 km. towards the south-east. Ever since leaving the second pass of the day before we had been following a distinct track; and the farther we advanced the more frequented did it grow. After we left Camp XLVIII the grass thinned off, and in some places the marshy, boggy ground was quite bare. Next we crossed diagonally over a level cauldron valley; the ab-



sence of watercourses showed that its floor was practically horizontal. On the other hand it contained an abundance of pools, several of which appeared to have been formed by the heavy rain that was still falling without intermission, and consequently they were only temporary. On the east this valley was bounded by a rather large mountain-range, though to the south-east the mountains were lower, and it was for a pass in that direction that we now directed our steps; beyond it we found two others. The highest of the three reached an altitude of 5100 m. All three were situated in secondary spurs, between which swollen brooks were flowing down towards the south-west; these no doubt formed the small sheets of water at some distance from our route, or possibly they only flowed through them. Here cropped out a close, hard, fine-grained rock at 80° S. Gravel here and there; otherwise all soft material, bearing miserable grass, moss, and flowers. Marmots, hares, and ravens were numerous; of the bigger animals we saw only some antelopes and a kulan. After a short intermission the rain began again with redoubled violence. Dense, black clouds encircled us on every side. But the rain did not fall out of them dropwise as it usually does, but it literally came in long connected streams, which splashed and spouted high when they struck the ground. Everything was wet and soppy, and our horses and mules, off which the water ran in bucketsful, ploughed their way through what was one continuous quagmire of clay.



Fig. 379. TIBETAN TYPES.

After we had crossed over the third pass, the route we were following became still more distinct. The country was very undulating and four or five times we crossed over flat offshoots by means of easy passes. In the glens between flowed brooks, which gradually ran together to form a larger one, and it in its turn emptied itself into a river. This we caught glimpses of winding along a broad open valley some distance to our left. On the farther, that is *its* left, side the river was bordered by

a very considerable mountain-range. We had also a range of moderate elevation on our right. The country still continued to undulate a good deal, for we crossed over a series of minor swellings by means of flat thresholds or saddles. Hard rock was however rare. All the watercourses carried water, which eventually made its



Fig. 380. TIBETAN TENT SCENES.

way to the river on our left. The grass was again excellent, and traces of encampments were pretty common. The river was now for the most part screened by the chain of heights which runs along its right bank. The track we were following was soon joined by another that appeared to come from the river. Anyway it ran towards the north and bore fresh signs of yaks having travelled along it, and later

on we overtook the caravan. The footprints of the animals made big gaping holes in the mire and were all filled with yellowish-red water, the colour being due to the red sandstone which was here everywhere predominant. The surface was now relatively level. We still had a mountain-range on our right, and off it the brooks

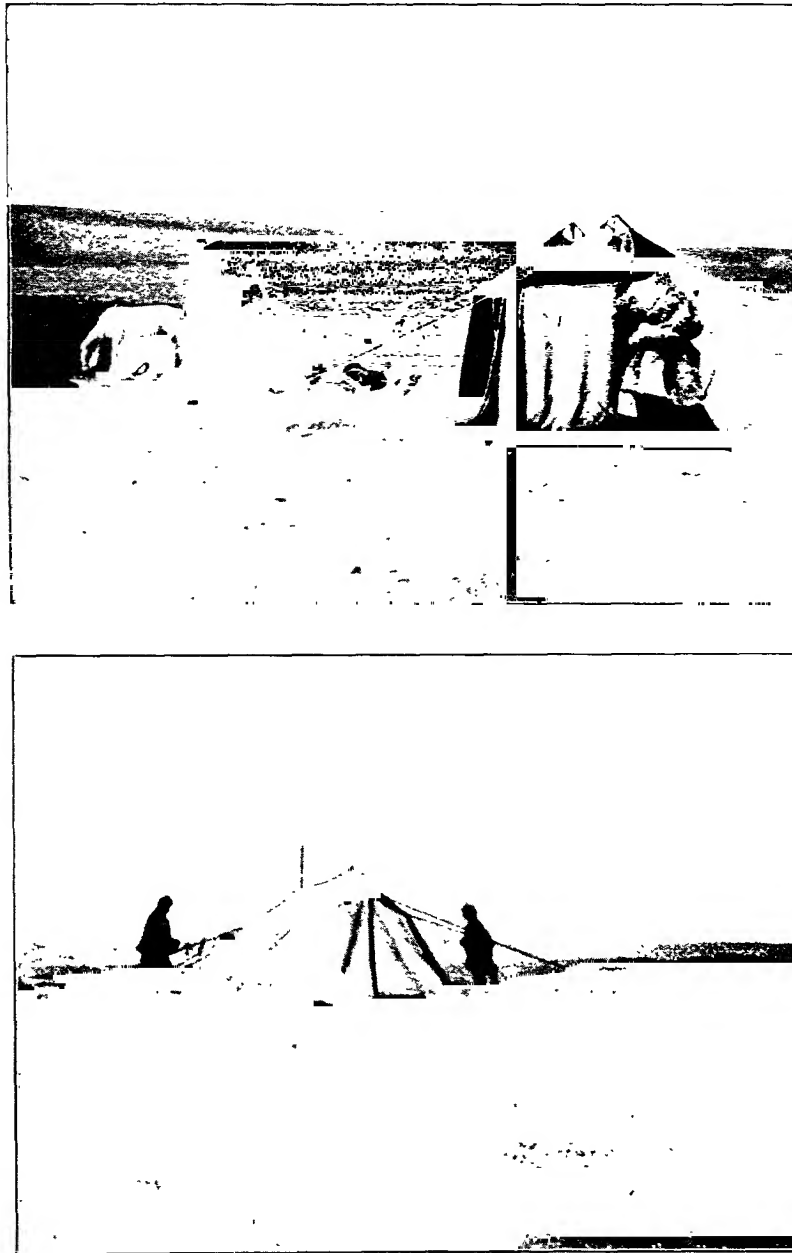


Fig. 381. TIBETAN TENT SCENES.

were running north-east down towards the river I have mentioned. We passed next an encampment of three Tangut pilgrims from Kum-bum. They had with them 50 *sarliks* (a cross-breed between the yak and the ordinary ox), a couple of horses, and dogs, and were on their way to Lhasa.

Some of the rugged buttresses of the range on our right approached quite close to the route. Then we crossed over yet another low saddle; and it was after that that we first came into contact with the Tibetan nomads, men looking after 700 sheep. We pitched our tent not far from theirs. We were still at a considerable altitude, for Camp XLIX stood at 5005 m., while the highest of the passes which we had crossed over reached 5113 m.

These Tibetans told me, that the name of that locality is Gom-dschima, and that the range which we had had on our right, and which rose immediately south-west of our camp, is called Haramuk-lurumak. The name of the river which we had seen on our left at some distance away, and towards which we gradually drew nearer on the following day, is the Gartschi-sängi. The locality in which we had pitched Camp XLVIII — they recognised it again from our description — is called Merik. These names are, I think, quite trustworthy, for later on I had the means of checking one or two of them, and found them perfectly correct.

Aug. 1st. From the tributary of the Gartschi-sängi, beside which we had encamped, we travelled on further towards the south-east, crossing gentle, grassy hills, above which bosses of rock and small ridges of gravel projected here and there. The river, which, when seen from a distance, had appeared rather insignificant, now began, as we gradually approached it, to assume the appearance of an important stream. Its *thalweg* grew more accentuated and narrow, though not so narrow but that we were able to ride without hindrance along the sloping ground on its right and at a considerable height above the stream, which makes several sharp turns. Here we crossed over a series of low passes and saddles. The rain still continued to pour down in sheets, and the ground was as soft and boggy as a morass. The surface was dotted over with the burrows of marmots. The water, which was everywhere flowing in a single channel, was a very muddy grey; I computed its volume to be about 20 cub.m. in the second. Hard rock cropped out on the outer side of the sharp bends. At the last pass that we crossed over the rock was a grey-green sandstone dipping  $48^{\circ}$  towards the S.  $40^{\circ}$  W.

By crossing over this last we passed out of the valley of the Gartschi-sängi and soon lost sight of the river; that is to say, it disappeared in the rain towards the south-east, or possibly towards the east-south-east, and emptied itself into the principal river, which was near at hand. We now came out into an almost perfectly level country; namely another flat longitudinal valley, soppy to a degree owing to the persistent downpour. Upon reaching the top of some low grassy hills, where there were numerous traces of encampments, we perceived what we at the first glance took to be a lake; it was a broad expanse of water, the opposite side of which we were unable to see because of the pouring rain. But it soon revealed itself as a gigantic river. The track ran straight down to the water's edge. The stream, flowing westwards, was thick and of a yellowish grey colour. This was the Satschu-tsangpo, one of the biggest rivers in the interior of Tibet. Farther west it falls into the salt lake of Selling-tso, where later on we struck it again at the point where it enters the lake. The river was now swollen in consequence of the heavy downpour which had been going on steadily for some days past. But if we desired to continue our journey towards the south-west, there was no alternative except to ride across the stream; there was no other road.

Here I had of course no opportunity to do more than make an approximate estimate of its volume; although, I admit, it would have been interesting to know exactly how great a quantity of water does flow during the rainy season down a highland river that empties itself into a self-contained drainage-basin. It took us 26 minutes to cross over the full breadth of the stream, making use of its mud-banks on the way; most of these were flush with the surface of the current, though one or two projected above it. By means of these mud-banks the entire mass of water was divided into 20 branches, each big enough to make an ordinary Tibetan river; but four were of extraordinary size, and the passage of them was not unattended with real danger. The roaring, boiling torrent did indeed carry away one of our mules, though she managed to save herself by swimming.

I calculated the breadth from the number of steps my saddle-horse took, namely 716, and these I computed to be equal to 475 m. The maximum depth amounted to 1.20 m.; the four largest branches had, I dare say, a mean depth of about one meter, while the others were only half as deep or less. I estimated the mean depth of the entire river at 0.60 m. Nor is this exaggerated; for the figure which I have quoted above for the breadth includes only the actual water-breadths, that is to say it disregards the mud-banks. It was more difficult to estimate the velocity; the only way I could do this was by comparing it with what I remembered of the corresponding phenomena in the case of the Tarim. In some places, especially in the big collected branches, the velocity was considerably more than a meter, and may in some places have been 1½ to 2 m. in the second. But in the smaller, shallower channels it was very much less. I should put the average velocity throughout at 0.75 m. in the second. On the basis of these estimates, the volume per second works out at 205 cub.m., and I venture to think that the estimate is too low rather than too high. Thus the Satschu-tsangpo is essentially bigger than the Tarim at Abdal at the spring-flood season: for we have found that the volume of the latter is then 1.40 cub.m. in the second. Yet how different the two rivers! Properly speaking, the only resemblance between the two is this, that each is the principal artery in a self-contained drainage-basin. The basin of the Satschu-tsangpo, or rather of the Selling-tso, is in point of area only a fraction of that of the Tarim, while in the matter of length the Tarim is several times longer than the Tibetan river. The Tarim dwindles, as we have seen, from source to mouth, and in proportion as it approaches its terminal lake, the smaller grows its volume. The Satschu-tsangpo on the contrary increases in strength as a consequence of all the big tributaries which it picks up in its main valley, this being one of the great latitudinal valleys of the interior of Tibet, stretching from east to west. There is also a great difference between the fluctuations of the two rivers during the different seasons of the year. The Tibetan river was now evidently at its maximum, which coincides with the rainy season, that is the latter part of the summer, at which time the lower Tarim is at its lowest ebb. When the latter reaches its highest level, that is late in autumn, the Satschu-tsangpo will pretty certainly be shrunk to the smallest insignificance. In the Tarim the fluctuations of volume are more evenly distributed, and the transitions from high water to low water and *vice versa* are less abrupt than in the Tibetan river, in which the changes of level even in the course of 24 hours may, in consequence of the

rainfall, be remarkably great. The flow of the stream and the transport of water take place in the Tarim throughout the whole of the year; but in the case of the Satschu-tsangpo, it may safely be assumed, that the river only flows during the rainy season, and even then only intermittently, according as the rain falls, whereas during the winter the river will be virtually to all intents and purposes moribund, except for the spring-water which at that period finds its way down its bed, though that will soon freeze. Most of these dissimilarities which I have alluded to are of course to be ascribed to the different lengths of the two rivers, and to their positions with regard to the higher grounds which collect the precipitation for them both. The winter temperature plays a less conspicuous part, for in general the cold will probably be as great in the basin of the Tarim as in high Tibet. The real sources of the Satschu-tsangpo would no doubt be found on the southern slopes of the Tang-la, the same immense mountain-system that gives birth to the Jang-tse-kiang, the Mekong, and the Salwen, the first on the northern, the last two on the southern versant respectively. It is probable that there are localities along the outermost border of the drainage-area of the Satchu-tsangpo which are separated by only *one* ridge or range from these great streams that flow down to the ocean. At all events the sources of all these rivers are to be sought for within a relatively not very extensive area in the eastern part of high Tibet. Seeing now how great are the effects of the copious rainfall during the rainy season in the relatively short and insignificant Satchu-tsangpo, it is no straining of probability to suppose that they will be incomparably greater in the big rivers that run down to the sea. It would be a task, as grand as it would be pleasing, for one who had the necessary time and inclination, to investigate and clear up the relations within the source region of these great Chinese and Indo-Chinese rivers. One is amazed, even after casting a fugitive glance upon the map, to see that within the relatively narrow space of 200 km. four large rivers are thus pressed together as it were into a sheaf. If this unusual hydrographical arrangement is intimately connected with the little known orographical structure, it is at all events strange that these rivers, flowing so close together and having issue from a common source region, which in point of area can scarcely be bigger than the source region of the Jarkent-darja and the Kaschgar-darja, and in any case is incomparably smaller than the united source-areas of the whole of the Tarim system, — it is strange that they should nevertheless carry so much the greater volumes, so that each of them singly in this respect pretty certainly excels greatly the Tarim. This dissimilarity depends no doubt upon the different amounts of precipitation. While the border-ranges of the Tarim basin, by reason of their more central position, arrest a smaller amount of precipitation, the amount which falls within the source region of the Chinese and Indo-Chinese rivers must clearly be much more abundant. But beyond doubt the same difference obtains in the oscillations of volume between these last-named rivers and the Tarim that obtains between the Tarim and the Satschu-tsangpo, and the difference is intimately connected with the capability of the respective mountains to magazine the precipitation. This capability would seem to be greater in the case of the border-ranges of the Tarim basin than in those of Eastern Tibet. Hence it is that the oscillations of volume in the Tarim are relatively so insignificant, while the Indo-Chinese rivers

no doubt exhibit greater variations in this respect. If, as a consequence of chance irregularities in the monsoons, the rainy season brings a smaller downfall than usual, the result must of necessity be expressed with great distinctness in the volume of the Indo-Chinese rivers, and it is in the highest degree unlikely that the thaw-water from the snowy mountains within their source-area is sufficient to compensate for the deficiency; whereas the Tarim on the other hand, in whose border-ranges a definite rainy season can hardly be said to exist, is maintained in years of scanty rainfall by the masses of snow stored up during preceding winters.

Further, it may quite safely be taken for certain, that the same annual fluctuations which I have pointed out in the case of the Satschu-tsangpo must also take place in the great peripheral rivers. But these fluctuations must of course be very much more sharply accentuated in the first-named river because of its relatively short course than in the big rivers where the changes are modified by the existence of numerous springs and tributaries. Anyway a short ride such as mine during the rainy season through the basin of the Satschu-tsangpo is sufficient to convince me that the big rivers, which have their sources in the same part of Tibet, must during that period gather up enormous quantities of water. When the rainy season is over, and winter has come with its intense cold, the upper parts of those rivers must shrink to the smallest possible dimensions, while all the spring-fed streams and tributaries which have helped to augment their volumes freeze to the bottom, and in fact cease to flow almost entirely, indeed the rivers themselves become ice-bound — and the effects of all these circumstances must of course be propagated to the lower parts of the rivers, and that to a far higher degree than is the case with the Tarim.

Even in the course of a hurried journey on horseback one cannot help observing the important part which the mountain-ranges play with regard to the precipitation. The range which we crossed over by the pass 5462 m. high, and which on both sides of the pass rises considerably above the snow-line, undoubtedly forms the westward continuation of the Tang-la range, which has been long known; on the north of it the precipitation was far less than in the country to the south of it. The most extensive lacustrine region of Tibet is also situated to the south of this range: though it is also true that on the north of it, on the high plateaus, there are a number of lakes, but not only are they more scattered, they are also smaller in area. This immense range consequently forms a climatic dividing-line, which, if not indeed sharply defined, is nevertheless distinguishable. As we have already seen, the grazing-grounds that the nomads resort to are to be found solely and alone on the southern side of the range in question, so that in addition to being a climatic dividing-line, it serves also as an ethnological boundary, for the region to the north of it is uninhabited.

I may also call attention to another very interesting boundary which strikes the Tang-la at right angles. It is not indeed very distinct on the map, in fact it is not distinguishable at all; at any rate there is nothing else to show it except the hydrographical arrangement. If on the map of East Tibet we draw a line joining the ultimate sources of all the rivers which issue into the ocean, we have in that line the boundary to which I allude. When we come, in the fourth volume, to dis-

cuss the absolute altitudes, we shall have an opportunity to investigate this important water-divide more closely. For the present it must suffice to say, that, like the water-divide between the Indus and the Brahmaputra, it is a flat swelling that forms a more or less curved meridional line, through the lower part of which the Brahmaputra breaks. True, although there do undoubtedly exist immense latitudinal ranges between the separate source-regions, still an integral part of the water-divide with which I am dealing consists of flat swellings in the latitudinal valleys between the mountain-ranges. Now these swellings are of exactly the same morphological rank as those which on the Tibetan plateau constitute the east-west water-divides between the several self-contained drainage-basins. With some of these we have already come into contact in the preceding pages. And with the view of rendering this characteristic morphological feature of the plateau-country of Northern and Central Tibet still more intelligible, I propose to conclude this present volume with a condensed account of the journey which I made along the great latitudinal valley south of the Arka-tagh in 1896. The latitudinal valley that lies next to this on the south has been traversed from end to end by Wellby and Malcolm. Both these valleys consist throughout of an unbroken chain of self-contained basins, with in almost every case a salt-lake in the middle. Each of these basins is bordered on east and west by a very flat threshold. To the south of the latitudinal valley which Wellby has described I crossed over a whole series of similar latitudinal valleys, the only difference between them being, that the farther south one advances the more indistinct they become, often indeed the valley is continuous. At all events from the scanty information which we have regarding these regions, it appears that each of them possesses towards its eastern end a terminal basin, bordered on north and south by mountain-chains more or less distinct, on the west by a flat threshold and on the east by a similar flat threshold. At the same time this last constitutes also an element of the great and important water-divide of which I am speaking and off the eastern versant of which the water streams down to the sea. The river Satschu-tsangpo, which gave occasion to this digression, belongs presumably to the latitudinal valley that we crossed over in the course of the day's march which I have recently described, and to the most easterly of its self-contained basins. I say it belongs presumably, for little or nothing is known with regard to the source-region of this river; for Bonvalot's, Rockhill's, Bower's, Littledale's, and this present hurried excursion of mine, which I am now describing, all have to do with the lower part of the river only. However I had an opportunity subsequently of studying the region of its estuary more thoroughly than I was able to study any other part of its course, and Rockhill has surveyed a part of it which cannot be very far from its source (see Vol. IV).

Where I crossed over the Satschu-tsangpo, a short distance below the confluence of the Gartschi-sängi, its latitudinal valley appeared to extend to the N.  $82^{\circ}$  E. and to the S.  $85^{\circ}$  W. At that point the river-bed is, as we have seen, very shallow and broad, and had an erosion terrace on its left side only; this was very seldom steep and hardly more than 2 m. in height, as a rule indeed it is lower and has a rounded face. Seeing however that it is just at this point that the Lhasa road crosses the river, it is fair to assume that this ford is the best and the most



convenient, and that both above and below it the river is both narrower and deeper, and does not admit of being forded during at any rate the summer and the rainy season.



Fig. 382. TIBETAN CAMPS.

After traversing a belt of almost barren ground, we encamped on the left side of a little tributary of the Satschu-tsangpo. Camp L had an absolute altitude of 4864 m., so that the river at the ford lies a little lower than that. The tributary, which in the afternoon had a volume of a couple of cubic meters, swelled towards evening to three times that size, the reason being that the rain which fell during

the earlier hours of the day only then succeeded in getting so far down. As no doubt the same thing holds good of all the numerous brooks and tributaries that empty themselves into the Satschu-tsangpo, it is easy to imagine the effect they produce upon the main river. At the moment when we crossed over it the Satschu-

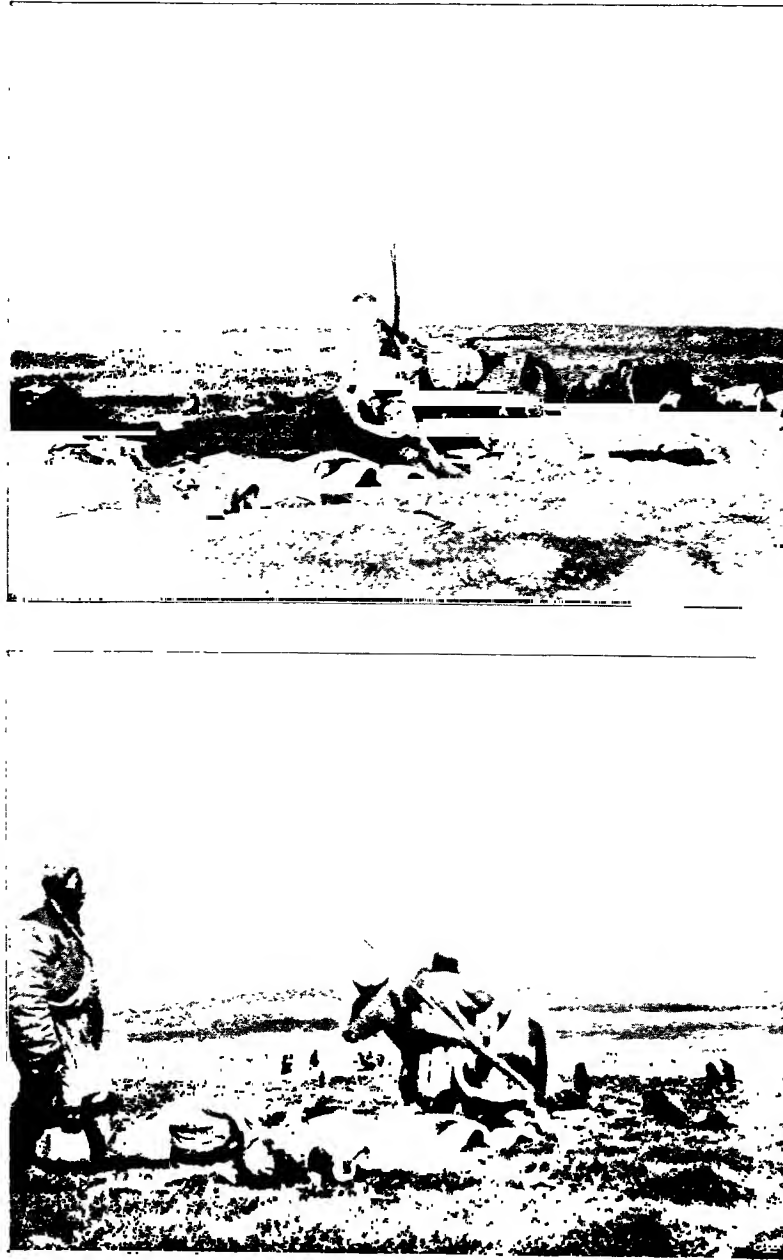


Fig. 383. TIBETAN CAMPS.

tsangpo was rising rapidly, and had we reached it a couple of hours later, it would undoubtedly have been impossible to ford it at all. By the next morning however the little tributary had dropped considerably, and its water was then clear. On the 2nd August the weather was beautiful, and though the sky was clouded, we accom-

plished our ride without a wetting from the rain. Unless therefore this little tributary made a solitary exception in the whole of the drainage-area of the river, the Satschu-tsangpo was no doubt also rapidly falling at the same time.



Fig. 384. TIBETAN CAMPS.

During this day's ride, which was wholly towards the south-east, the scenery remained tolerably uniform. Crossing the brook twice, we travelled up beside it to the flat pass from which it flows, leaving on our right, at the distance of a couple of kilometers, a nomad encampment with 20 sarliks and about 400 sheep. The altitude of the pass was 4945 m. Over on the other side we threaded a number

of low hills separated from one another by gullies and small brooks. On the left we had a low range, on the right a flat, open plain, or sort of extensive cauldron valley, with regard to the real value of which I was unable to obtain any clear conception. While on the one hand it resembles an independent self-contained basin, it is more probable that it only forms part of the basin of the Satschu-tsangpo or the Selling-tso. In two small thresholds black argillaceous schist cropped out at 60° S., while the loose pieces of rock consisted of a hard variety of rock, resembling light-coloured porphyry.

After that the country was very level, and were it not that the surface was so sodden and so disagreeably softened by the rain, the going would have been particularly good. By this we had descended nearly 100 m. below the pass I have mentioned. The grazing was miserably poor. The incredible amount of tame-yak dung proved that we were travelling along a much frequented road. Southwards the country appeared to be flat; in fact there were no higher mountain-ranges at all in that direction, only stretches of low rounded hills.

Beside a little spring, with grass all round it, we found a big Tibetan trading caravan resting. It consisted of 25 to 30 men, with 300 yaks, laden with tea sewn up in bales. They said they came from the neighbourhood of Kum-bum, and were bound for Taschi-lumpo. When actually marching the caravan was divided into several groups, and the men travelled on foot. They were journeying by night only, so as to give their animals an opportunity to graze by daylight, and were making only short stages.

At the next spring, just south of the road, we pitched our own tent, Camp LI, at an altitude of 4836 m. Thus we had now reached a somewhat lower part of the Tibetan plateau country; yet it was not until the following stage that we got down below the level of Mt. Blanc.

After a beautiful morning, the heat being almost oppressive, a violent thunder-storm burst over us in the afternoon, while the hail beat so furiously upon our tent that it almost threatened to flatten it level with the ground. This was followed by three hours of rain. Strange to say, the sky all round the horizon was clear; the heavy clouds, which were discharging their contents upon us, appeared to hang stationary above the cauldron valley in which we were encamped. The violent crashes of the thunder gave rise to a peculiar and unusual acoustic phenomenon, such as I had never experienced before. The thunder-clap, after vibrating for a long time and with dwindling force, died away at a great distance with a clear metallic echo like that of a church bell. This peculiarity may possibly be in some way dependent upon the general configuration of the country. At any rate that configuration affected the rather crisp south-easterly wind which during the night swept along the northern foot of the hills, driving before it dense masses of cloud, which seemed actually to follow a predetermined course, like water flowing down a river-bed. Although our camp stood quite close to the path of the wind, it remained in almost perfect quietude.

Aug. 4th. According to the men of the yak caravan, the district in which we then were is called Amdo-motschu. Thence they estimated it to be five days to Naktschu, and to the pass of Lani-la seven, though evidently short days.

The road, which we still continued to follow without knowing where it led to, carried us towards the south-south-east, across the broad cauldron valley, or more correctly the eastern end of the great latitudinal valley. Some 10 kilometers farther to the east, it appeared to be bounded by low hills. We crossed over a



Fig. 385. TIBETAN CAVALRY.

great number of brooks, containing but little water, though bordered by marshy, treacherous ground. All these watercourses gather into a river, that runs towards the N.  $70^{\circ}$  W., and no doubt terminates in some small lakes which we saw south of Camp LI. A few kilometers beyond our last camp the road bifurcated, one

branch running towards the S.  $78^{\circ}$  E., towards a gap in the hills. That branch, which we passed on our left, leads no doubt to Naktschu. Not far from the bifurcation there is an obo on the plain, that is a number of slabs of red sandstone

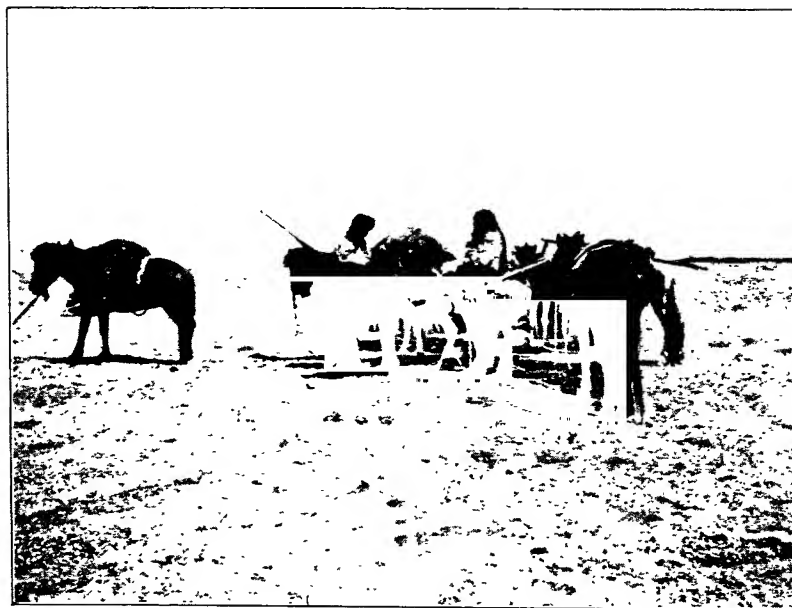
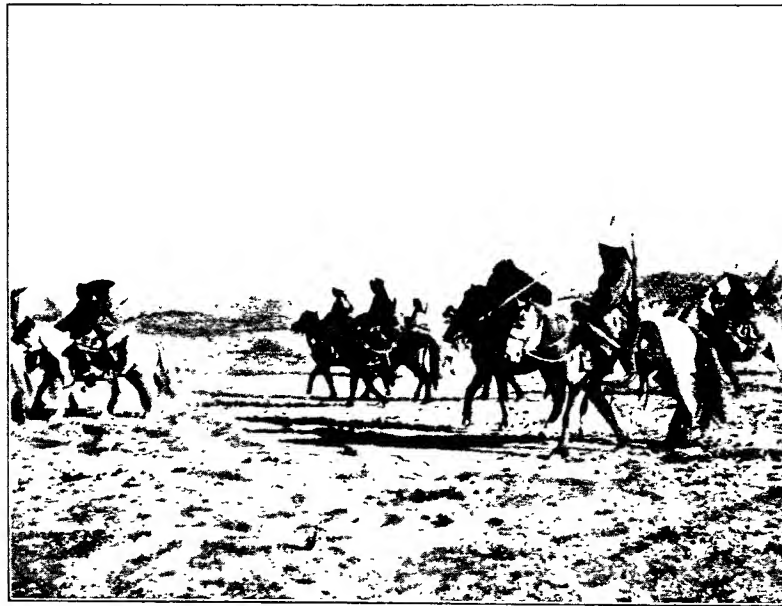


Fig. 386. TIBETAN CAVALRY.

bearing engraven on them the formula »On mane padme hum». Here again we met another caravan of about a hundred yaks, travelling north with light loads. We nowhere saw solitary travellers either on foot or on horseback: it seemed to be the custom to travel in large, well-armed companies.

At length we reached a scarcely noticeable water-divide or threshold (alt. 4837 m.), where red conglomerate cropped out at  $84^{\circ}$  to the S.  $25^{\circ}$  E. Here too there was an obo of the same appearance as that which I have just described. On both sides of the saddle were several tents and herds. The brook which runs south-east from the saddle, and which we accompanied, is set about with numerous springs and marshes, and also with excellent grass; and signs of encampments were numerous everywhere. The surface was however literally honeycombed with the runs and burrows of the earth-rats. We were probably travelling then by the same route that Bonvalot followed. It bore evidences of lively traffic, in a number of parallel, much trodden tracks, although at that particular season it did not appear



Fig. 387. TIBETAN CAVALRY.

to be much used. In a cauldron valley, encircled on all sides by low hills, we saw several herds of yaks and flocks of sheep grazing, and in two places also troops of horses. The grazing there was first-rate. This locality is much frequented by nomads, though at the approach of winter they move farther south. Beside a couple of small freshwater pools we counted fourteen tents, all with large herds. It seemed as though some of them intended to stay the winter, for beside them were great piles of yak-dung, which had been collected, dried, and in this way stacked up. We made Camp LII (alt., 4736 m.) on the left side of the main stream that gathers up all the brooks of the locality. The weather this day had been exceptionally favourable.

On the 5th August when we started again the river wound away to our left, making for a moderate-sized lake, which appeared to stretch east and west. In point of fact, I was told that it is a double lake. Its western basin, on the west shore of which we were marching, is called Tso-tscha and the eastern basin Tsonak.

On our right, that is to the west, we had low hills, from which several brooks descend to the river and the western lake, as also to several pools situated alongside of it. Tented villages were dotted all round the shores. We travelled nearly all day towards the south-south-east, crossing on the way over a great many shallow



Fig. 388. OUR TIBETAN ESCORT CROSSING THE SATSCHU-TSANGPO.

valleys, with small brooks in them, all of which make their way into the lake. We also went over three small passes, of which the highest, the middle one of the three, reached an altitude of 4918 m. The tents of the nomads began to stand closer and closer together; in a district called Tsukar they were especially numerous.



After crossing over yet another broad valley, with twelve tents, and large herds, we encamped beside a little brook. By some this place was called Dschalok, by others Schiker, while the relatively important mountains which we saw to the west were said to be called Bontsa. The altitude of Camp LIII was 4845 m. It was here that I and my two attendants were prevented from proceeding farther in the direction of Lhasa; from what we were told, we were five days distant from the holy city, and we were one day's journey from Nam-tso or Tengri-nor. During the five days that we stayed there, it again rained pretty heavily and all the brooks ran full.



Fig. 389. OUR ESCORT.

On 10th August we started on our return journey, accompanied by an escort of Tibetan horsemen. They took us back the same way by which we had come, but knew of far better camping-grounds than those we had found out for ourselves. For instance, in one or two of the smaller side-valleys the grass was far better than any we had seen elsewhere in Tibet. But we did not succeed in gleaning any further intelligence from our guides. They called the country to the west Namru, while to the east lay the densely inhabited regions of Tsamur and Amdo. In consequence of the last rain the road was far more difficult than it was on the way out. Camp LVIII was pitched in a locality called Gonggak, where there were a few fragments of fossiliferous stone scattered over the ground, although it was quite impossible for me to examine into their provenance. Possibly their presence there was a pure accident, for I failed to perceive any hard rock anywhere in the vicinity.

Our Tibetan escort accompanied us as far as the Satschu-tsangpo, for that stream forms, they told us, the limit of the Dalai Lama's authority. The river had in the interval subsided a good deal, being not half as big as when we forded it before, so that this time we got across it without difficulty. We formed Camp LIX a good distance above the first nomad camp that we saw at Gartschi-sängi. Here on

the night of 15—16th August we had a rainfall of unparalleled heaviness, the darkness being absolutely impenetrable, for there was no longer any moon. On the encircling mountains the downfall assumed the form of snow, and in the morning the mountains themselves were all white.



Fig. 390. LAMA TALKING WITH THE CHIEF OF OUR ESCORT.

On the 16th August we kept rather to the east of our former route in order to avoid the numerous small passes; that is to say, we marched closer to the bed of the Gartschi-sängi. As this tract also proved unfavourable for travelling, we quitted the vicinity of the river and returned to the big valley in which we had made Camp XLVIII. Here we intersected our former route, leaving the camp just mentioned on the right at the distance of a couple of kilometers. At this time we were travelling almost west. On our right we passed a couple of smaller lakes; while close to our left we had a large stream, which gathers up the water of all that district and then flows towards the east, where it no doubt empties itself into some little self-contained lake. Finally we turned off towards the north-west, and crossed over several of the contributories of this stream. They traversed broken ground, which sloped gradually upwards in the direction in which we were marching. Camp LX, on the left bank of a main stream, had an altitude of 5114 m. This stream, which is possibly identical with the one that I have just mentioned, is divided into several branches and surrounded by gently swelling hills, bearing scanty grass, but without any hard rock.

On 17th August we did not once touch our former route, but traversed a country of quite a different relief. All the same the distance between the two routes did not amount to many kilometers. We crossed over the same range as before by a somewhat lower pass, the ascent up to which was easy and regular; for we were able to follow towards the west-north-west the valley in which we had encamped. This was fairly broad and was traversed by a good-sized stream, the

bottom of which, although consisting of nothing but sand and mud, without any gravel, was nevertheless hard. It is inclosed between steep hills of brick-red shades, built up of the disintegrated products of red sandstone and coarse conglomerate. The former, not far above the camp, dipped  $24^{\circ}$  towards the N.  $5^{\circ}$  W. Farther away the mountains rose on both sides into loftier masses, though these too consisted of softly rounded eminences without hard rock. The pass, which formed a flat threshold, rose to an altitude of 5212 m. The prospect which unrolled itself from the top was not especially enlightening. There was no dominating latitudinal valley, nothing but a chaos of minor crests. The glen that descends westward from the pass has almost the same appearance as that on the east, and the two lie in



Fig. 391. A TIBETAN LEADING TWO OF OUR PACK ANIMALS.

the same straight line. Here too we had the same brick-red hills. Farther on the glen became increasingly more like a cañon: at one point it was perfectly impassable and we were forced to make a short, but difficult, detour over the heights on its left, where the surface in all the eroded watercourses was soft and marshy. These heights commanded however an excellent view of the fantastic relief of that picturesque country. After that we once more travelled along the main glen, which was now joined from both sides by a great number of similar deep, narrow cañon-like side-glens. The lower entrance of each of these yawned upon us like a dark gateway. At such places the hard rock crops out, namely red sandstone dipping  $85^{\circ}$  towards the S.  $10^{\circ}$  W. As the glen runs towards the west-north-west, or parallel with the strike, it is often particularly straight and affords a free outlook along its course; but when, later on, it inclines more to the west and west-south-west, it becomes at the same time more sinuous. Having got into this glen, we were like rats in a trap: it took us too far out of our course, and long we looked in vain for a suitable place by which to climb up the slopes on the right. We saw kulans

and antelopes occasionally; also any quantity of yak-droppings, which we truly did not expect to find, but we were unable to make out whether they were left by wild yaks or by tame. On the one hand wild yaks shun narrow, inclosed localities; but on the other hand it is little likely that the nomads would wander so far astray. Possibly they were due to the convoy of a large hunting party. The surface in this glen consisted of nothing but mud, without any gravel, and was often very treacherous, and we had to proceed with the utmost caution.

At length however the side-hills grew lower, and permitted us to quit the glen on the left-hand side. The glen itself appeared to continue towards the west-south-west towards a not inconsiderable lake, which we saw in the S.  $70^{\circ}$  W. to W. at a distance of about 8 km. Accordingly we now aimed for the north-west across greatly broken ground, namely a series of gently rounded hills and ridges, with dangerous boggy ground, separated from one another by small glens, all of which run down towards the principal glen and lake. The grass thinned out and came almost entirely to an end; and after that the vegetation was confined to moss and japkak, rhubarb and garlic, this last furnishing excellent nourishment for both men and animals in our caravan. We pitched Camp LXI beside a couple of small pools at an altitude of 4924 m.

On 18th August we traversed a region which for sheer »cussedness» would be hard indeed to beat. It was tolerably broken; still we managed to keep pretty much at the same level, the vertical differences amounting to only a score or so of meters. But it was very rarely that the ground would bear the weight of our caravan animals; it was like riding amongst cunningly hidden traps and pitfalls. For a short distance we kept on towards the west, then towards the north-west, crossing at first over several small brooks, all streaming down to the lake or to pools close beside it. Alongside one of these brooks we perceived a track, which had clearly been used by hunters. From a minor pass we caught sight of a little lake to the south. On the other side of the pass we descended to a self-contained basin, in the middle of which was another lake, somewhat larger; this we left a couple of kilometers to the south. The ground around this lake was really the most detestable that I have ever had experience of — nothing but super-saturated ooze to which there was no bottom. Even in those places in which the ground had dried superficially in the glorious sunshine, our caravan animals sank in at every step. The entire locality is a cesspool or gathering-basin into which all the mud and ooze is washed down off the surrounding heights, until at length it forms a veritable slough of despond, no single inch of which will bear. It is traversed by a countless number of small water-channels a meter across, all of which converge upon the lake. The only ground that was at all of firmer consistence was that over which the water was actually flowing; but only one or two meters away it was as soft as a sponge or blotting paper from having absorbed moisture from the adjacent basin. In some places the ground was dry, but it was then as soft and powdery as flour. Of hard rock there was of course not a trace to be seen: it was all material in the conceivably finest state of division, amongst which it was impossible to discover the very smallest chip of rock. Had heavy rain chanced to fall just then, this region would certainly have been absolutely and entirely impassable.

At length we turned our backs upon that abominable slough, and climbed up to a little threshold, on the other side of which we again found a chaos of broken ground and hills. Our animals were dead-beat from their exertions, and we stopped and rested a couple of hours on a grassy mound. The heat was literally baking, for the thermometer registered  $19.6^{\circ}$  in the shade, while on the surface of the ground in a dry place it registered  $48^{\circ}$ . The atmosphere was perfectly still and calm, so that we might readily have imagined ourselves transported to some tropical clime. However there now occurred one of those sudden changes of weather which are usual in high Tibet. Threatening clouds loomed up in the west, and all at once an extremely violent hail-storm burst, and within a minute we were once more plunged into the midst of winter — chilly cold, wet, and windy. After an hour the wind veered round to the west, but did not abate its fury, and it was accompanied by rain; while in the evening the wind blew from the east. Then we continued our way towards the west, and encamped beside a brook at an altitude of 4957 m.

On 19th August we again encountered a very unfavourable country, namely an uninterrupted chaos of fresh ridges and lines of heights, all consisting of the same soft mire. On the northern slopes especially, which were less exposed to the sun, our animals often sank in up to the girths, and we crept on our slow, wearisome journey at a snail's pace. As far as we possibly could, we trod upon the clumps of moss or chips of sandstone, for both were fairly common on these hills. The slopes were seamed with watercourses more or less shallow, all brimming with mire and ooze. From another pass we saw to the north-east the salt lake on the shore of which stood our Camp XLVI. On our way from this second pass to a third pass we crossed over a *thalweg* going down to the lake. Its upper part afforded us comparatively advantageous ground to march upon until we came to the third pass, which reached an altitude of 5211 m. Here then we climbed over the same range which we had found farther east to plunge sheer into the salt lake, and which we consequently had been obliged to cross over there as well. From this third pass we also perceived the great cauldron valley or plain which we encountered on the first day of our journey out. A long way off to the north we beheld the glaciated range, the pass of which was however only 250 m. higher than that on which we were then standing. From the latter a brook runs down towards the north-west, and the ground in its bed was hard and firm enough to bear; at the same time we were able to march without danger on the slightly grassed slopes, the reason being that owing to their steepness they did not absorb the rain-water, but allowed it to run freely away. At last we got down to the level ground of the cauldron valley, and encamped at an altitude of 5070 m.

The next day, the last of this trying excursion, we passed Camp XLV at the distance of a kilometer to the north, and then by an easily recognisable trail reached our headquarters camp. But during our absence this had been moved into a little southern side-glen opening upon the main glen, where the grazing was better than in the main glen. On our journey out we had followed a far easier route than the latter half of that by which we returned, for this took us over too many passes unnecessarily.



MY JOURNEY ALONG THE ARKA-  
TAGH IN 1896.





## CHAPTER XXXI.

### OVER THE ARKA-TAGH FROM KAPA.

In order that I may gather together into one place all my investigations into northern and eastern Tibet, I have thought well to introduce into this volume a short account of the journey which I carried out in August and September 1896 in the great latitudinal valley that lies immediately south of the Arka-tagh, and is itself bordered on the opposite or southern side by the flat range which constitutes the westward continuation of the Koko-schili.\*

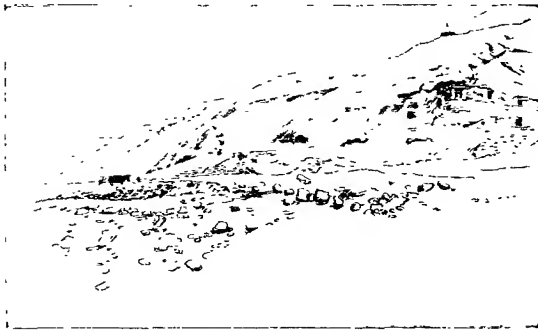


Fig. 392. KAPA.

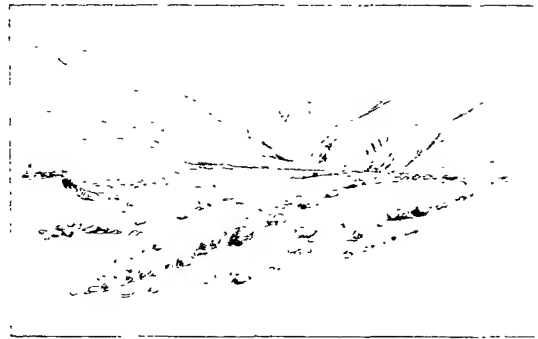


Fig. 393. THE VALLEY OF KAPA LOOKING S.

On 30th July 1896 I started from the gold-mines of Kapa (alt., 2521 m.) with a big caravan of horses, camels, and asses, intending to travel *via* Julghun-tschap, Kara-tasch, and Toghrak-tschap to Dalai-kurghan, crossing over the gentle spurs of the mountains on my way. I had been told by the natives, that at the place last-mentioned one could advantageously find a way up to the Tibetan highland. Our route crossed over the river Mit. which comes down out of a wild and spacious transverse glen opening out directly south. Shortly after emerging from the mountains, this glen expands to a breadth of several hundred meters, but still continues to be inclosed between steep gravel-and-shingle terraces. The river, which unites lower down with the Kara-muran, contained at that time no small amount of water, though it was divided into several branches scattered over its stony bed. The rock there consisted of a grey biotitic granite of medium grain. A steep path leads down the

\* I have already described it in *Peterm. Mitteil.*, Ergänzht. No. 131, pp. 271 ff., and of that description the present is a condensed extract.

terraces on the left to the river. The right escarpment is on the other hand so precipitous and high, that it would be impossible to ascend it, were it not riven by a side-glen, Jaka-tschap, which is likewise contained between precipitous gravel-and-shingle terraces, so that it resembles a miniature cañon. At length the relative altitudes decreased and we entered upon open ground, a steppe with good grazing, traversed by some eroded watercourses, such as Haschäklik or Su-ullugh-tschap and Togh-tschap. On the banks of the latter stand a couple of small villages or homesteads, which cultivate wheat. On the left we passed some smaller detached groups of mountains, as well as the road to Atschan. We pitched camp at the spot where the brook of Dalai-kurghan issues from the mountains, the altitude being 3311 m., so that since leaving Kapa we had already climbed up 800 m.

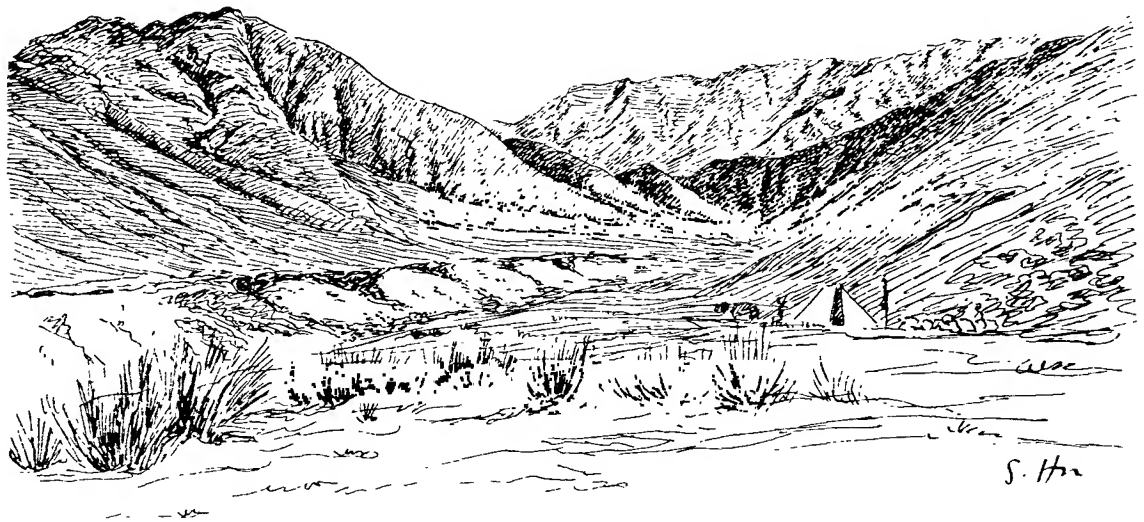


Fig. 394. THE OUTLET OF THE VALLEY OF DALAI-KURGHAN LOOKING SOUTH.

On the occasion of my visit there were 18 ujlik of Taghliks or Mountaineers, in charge of 6000 sheep. Most of them live in earth-caves (*sorugh*), though they also possess small huts of stone and timber. On the other hand they do not use cottages built entirely of stone, owing to their fear of earthquakes. In Kapa, where earthquakes are never experienced, the people live wholly in stone cottages. The road from Dalai-kurghan to Atschan crosses over the Kara-muran, the transverse glen of which is altogether impassable, for not only is it narrow and choked with stones, but at that season of the year it carried a considerable flood. The village of Atschan was said to consist of 25 ujlik, and there, as also in the villages immediately to the east — Ghudatsche, Isängän, Ak-jar, and Kuramlak (Korumluk) — wheat is grown; although the people live for the most part by sheep-breeding.

The brook of Dalai-kurghan, which lower down irrigates the corn-fields, is fed by springs, and consequently never dries up entirely. On the other hand the village of Togh-baj is dependent upon rain, and if that fails to arrive, the harvest is lost. The surface of the ground begins to freeze in the end of August, and for almost half the year it is said to remain frozen to a depth of 1½ m. The snow is reported to accumulate to a depth of 40 cm., and the Taghliks are then said to drive

their flocks farther north to lower and less snowy regions. In summer the rainfall is abundant and is brought by westerly winds, this being the predominant quarter. The easterly wind is feeble. Although this region lies so close to the Lop-nor country, the winds that obtain here, at the northern foot of the Kwen-lun, are quite different, and the violent east-north-easterly tempests do not appear to reach up as far as this region.

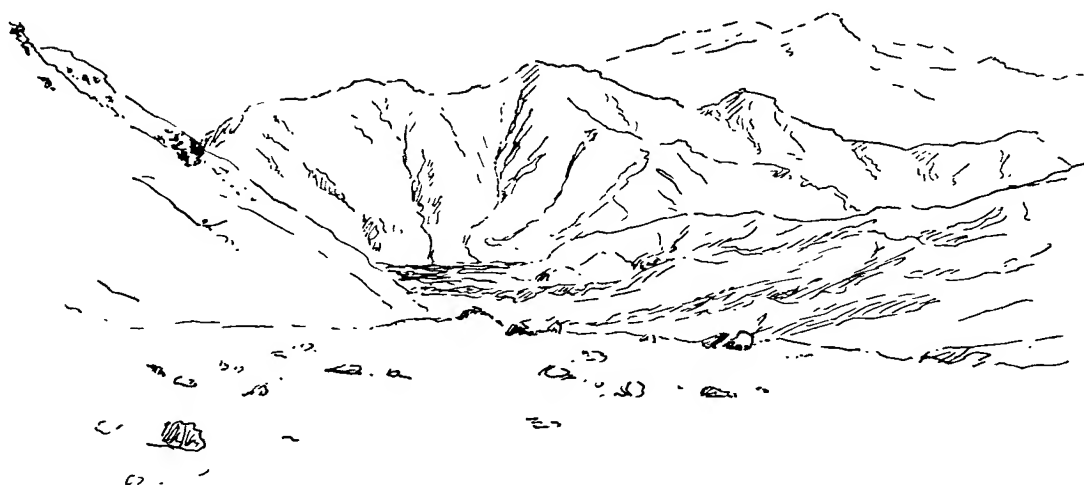


Fig. 395. VIEW FROM DALAI-KURGHAN-ART LOOKING SSW TOWARDS LAMA-TSCHIMEN.

Two passes lead across the northern border-range of the Kwen-lun system. With the object of examining one of these, Tschokalik-davan, I made a three days' excursion from our principal camp. At first the ascent was steep over gentle grassy hills, but subsequently we followed the glen of the Dalai-kurghan towards the south-east and south-south-west. The little secondary pass of Dalai-kurghan-art, which is situated in purely soft country and is easy to cross over, reached nevertheless an altitude of 4367 m., so that by this we had already climbed more than 1000 m. To the south-south-west extended the high plain of Lama-tschimen, bounded on the south by a huge range, and crossed by the river Mit, which, after making a bend towards the west, pierces the northernmost of the border-ranges by a north-going glen. Upon getting over the pass we turned eastwards at a sharp angle, thereby gaining a view to the south across the broad valley of the Mit. On our left we passed the entrance to the Sarik-kol-jilgha, and continued to ascend slowly over hard easy-going ground. The glen of Lama-tschimen, the eastern part of which is traversed by a little brook, is inclosed north and south between lofty crests, then perfectly free from snow. In the same range in which the Dalai-kurghan-art is situated there are two other passes, approached by the transverse glens of Tschirak-

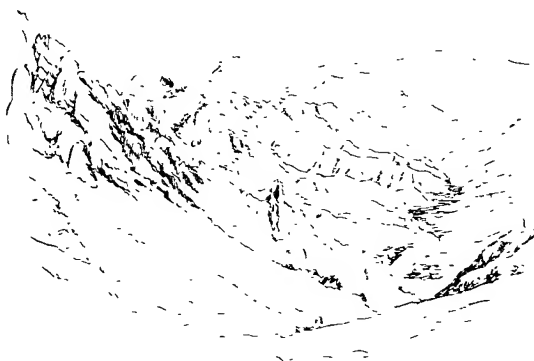


Fig. 396. FROM TSCHOKALIK-DAVAN TOWARDS THE ENE.

tikan and Jes-saj respectively. The ascent grew steadily steeper and the river which came down west from the pass of Tschokalik was in full flood, the water being muddy. Here we encamped at an altitude of 4285 m. There are said to be heavy falls of snow in this region, so that it lies up to two feet in depth. Lama-tschimen is only visited by the shepherds in summer. During this day's journey the predominating rocks were various varieties of schist. Granite occurred only at one place, namely at the bend of the Mit river, where we turned east.



Fig. 397. THE SARIK-KOL-VALLEY LOOKING N 60 E.

On the 2nd August we continued our ride up the glen, which grew narrower and narrower, and at the same time increasingly choked with schist detritus, while the vegetation decreased and soon ceased entirely. Occasionally the bottom of the glen was so full of stones that we had to make little detours over the slopes at the side; in such places the brook tumbled over cascades. The glen is confined within vast, imposing mountain-spurs, that project from the main range. We were now travelling towards the east-north-east. The eroded channel again widened out on the west side of the pass. By a steep acclivity we made our way up to the pass of Tschokalik, a rounded ridge having an altitude of 4932 m. On both sides of the pass the hard schistose rock cropped out of the detritus in wild, rugged peaks and pinnacles. The eastern face of the pass turned out to be too steep and difficult for a caravan. On the other hand the view was extensive: due east-north-east ran the eastern glen of Tschokalik with a grey gravelly bottom. This part of the glen is also inclosed between stupendous rocky walls and runs down into the main glen of

the Kara-muran, which has on its eastern side an inextricable chaos of great mountain-masses.

Our reconnaissance finished, we returned to Lama-tschimen, but then struck off northwards up the glen of Sarik-kol. The pass (4170 m.) at its head was even easier than that at the head of the Dalai-kurghan, and was likewise situated in soft material. We encamped in the lower part of the northern glen of Sarik-kol, beside an *aul* with 2000 sheep and 50 yaks. The altitude was 3574 m. The rocks through which this stage ran were schist, diorite, and granite.

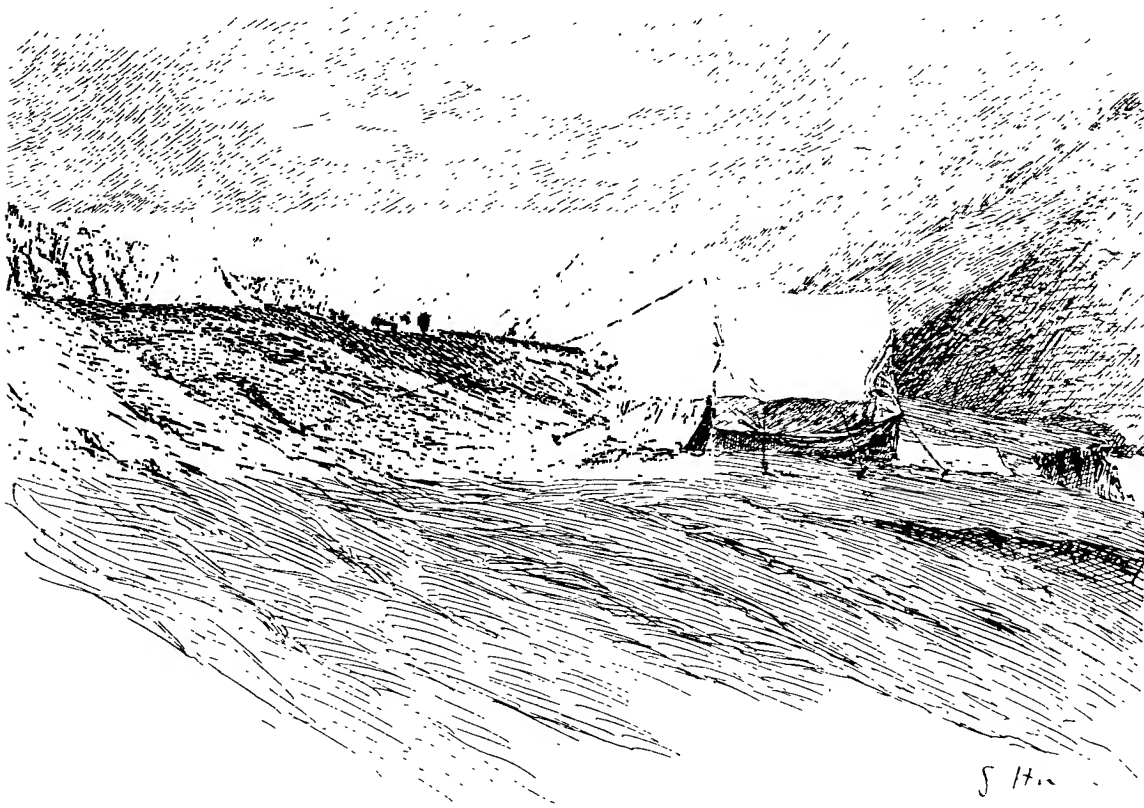


Fig. 398. SARIK-KOL-VALLEY LOOKING SW.

After proceeding on the 3rd August some distance farther down the glen, we turned to the west, and travelled up the glen of Joli-kol, and this brought us to a little secondary pass of the same name (3554 m.). Its acclivities on both sides are very steep, but the range is here built up of very rounded, grassy earthy hills. On our left was the little glen of Kuruk-kol. Making a wide sweep to the north, we approached the inhabited region of Kontsche-bulak, lying outside the mouth of the glen of the same name; this glen possesses a deeply incised *tschap* or eroded watercourse. It is reported to unite with the Kara-muran or possibly with the Mit, and collects its waters from over a wide area. Then we once more reached our main camp at Dalai-kurghan by way of Säsigh-tschap, Jätim-dung, and Sapa-tepe-tschap.

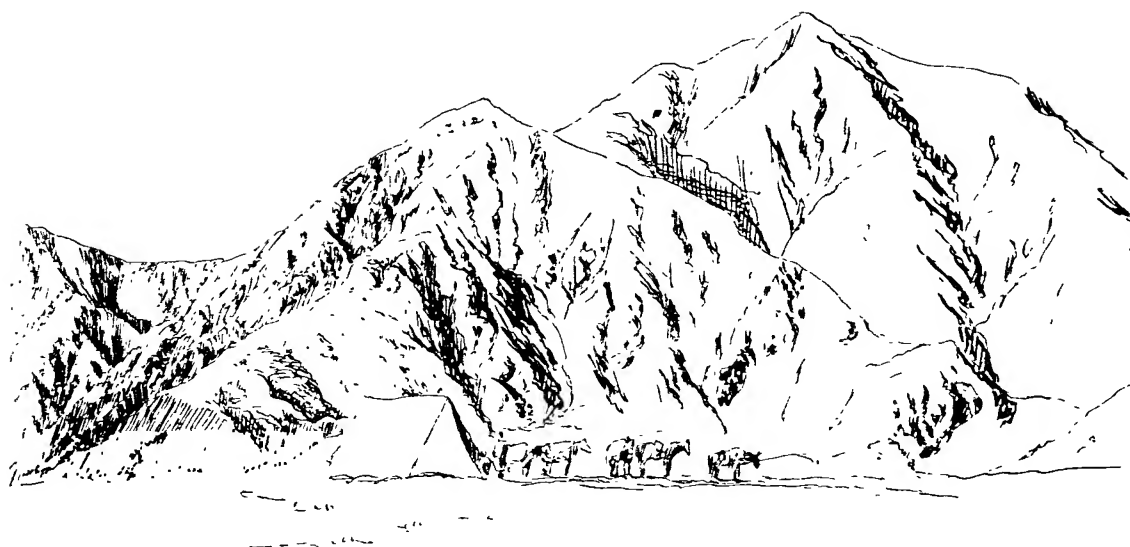


Fig. 399. OUR CAMP IN THE MIT VALLEY.

On the 5th August we started with the entire caravan, and travelled by way of Joli-kol and Sarik-kol, and on the following day, passing the western glen of Tschokalik on our left hand, we entered the recently mentioned great mountain-portals that lead off the river Mit. There cliffs of red granite predominate. We encamped beside the river in the district of Lajka at an altitude of 4008 m. The name is indicative of the great amount of sediment in the river-bed. The volume of the river was only 4 cub.m. in the second. On its right side it is fenced in by a thick terrace of gravel-and-shingle. The accompanying sketch (fig. 401) gives

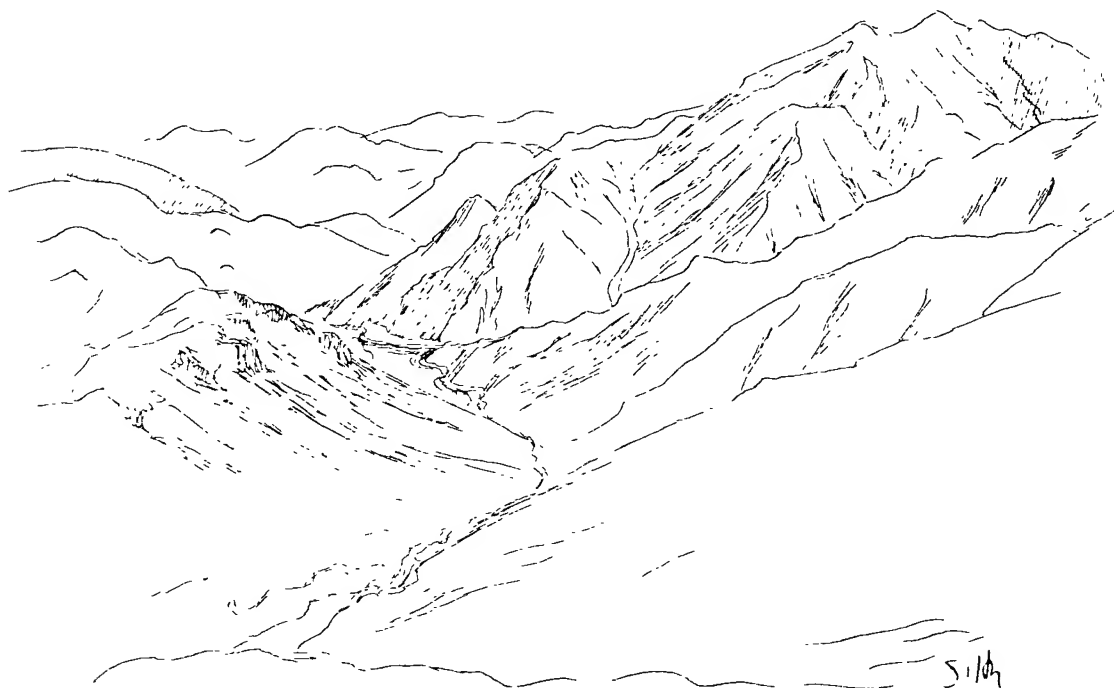


Fig. 400. LOOKING ENE FROM JAPKALIK-DAVAN.

an idea of the scenery to the south — huge masses of bare rock, cleft by the glens down which flow the spring-fed headwaters of the Mit. It was just as impossible to proceed from Lajka and Lama-tschimen up the Mit, and so reach the lowlands through its lower transverse glen, as it was to travel along the transverse glen of the Kara-muran. But by turning to the west, and leaving the lower extremity of the transverse glen on your right, that is to the north, you will follow a road, which leads up a minor side-glen to the little passes of Pelaslik and Kül-davan, both situated in a range that forms the water-divide between Mit and Kok-muran, one of the most important of the head-feeders of the Möldscha.

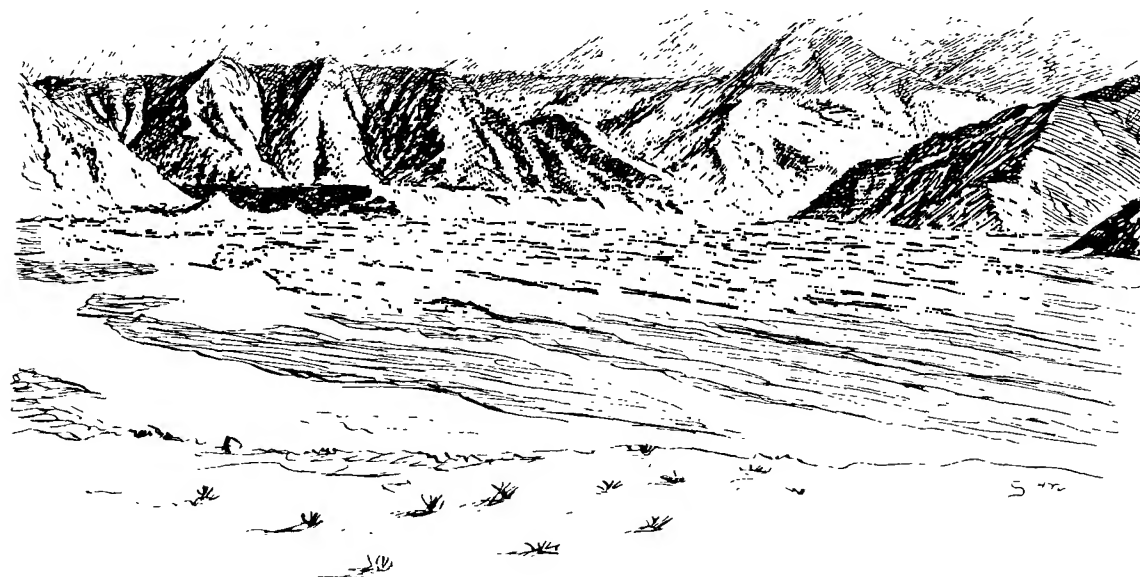


Fig. 401. THE VALLEY OF MIT LOOKING SOUTH.

On 7th August the river carried a volume of only 2.6 cub.m. in the second. We travelled up it along the above-mentioned escarpment on the right, which is cut through by the brook of Kisil-su, issuing out of an eastern side-glen. Shortly after that we left the main glen of Mit on the right and penetrated south-east up the glen of Japkaklik. Here schists predominated. At intervals springs gushed out at the foot of the mountains. From both sides entered several contributory glens, some with torrents, others without. Two of these bear the names of Kan-jilgha (with gold-mines) and Toghri-su. The pass of Japkaklik, situated entirely amongst disintegrated black schists, had an altitude of 4741 m. and was far easier than that of Tschokalik.

The eastern glen of Japkaklik-davan leads towards the east-north-east, the spur on its northern side being cut through by several glens, whereas the mountains on the opposite or southern side form a massive and continuous wall, which decreases in height towards the east, and finally is crossed over by the track which we were then following at the little pass of Kum-bojan (alt. 4167 m.), crowned with a cairn of stones. On the south of this secondary pass we descended by a side-glen that runs parallel to the eastern glen of Japkaklik, and like it forms a contributory glen to

the Kara-muran. The last-named river flows towards the north, picking up soon the glen that runs down eastwards from the pass of Tschokalik-davan. After that the main river with its deep and inaccessible glen turns to the north-west and cuts its way through the Tokus-davan, the most northerly border-range of the Kwen-lun. The district in which we encamped (alt. 4075 m.) is called Bulak-baschi; the brook that we found there, then insignificant, with crystal bright water, belongs to the system of the Kara-muran, though it is hardly its principal head-stream.



Fig. 402. THE GATEWAY; LOOKING SE



Fig. 403. LOOKING ENE FROM CAMP II



Fig. 404. LOOKING WNW FROM CAMP II.

On the 8th August we continued towards the east-south-east and south-east in a hard west-north-west wind, up a gently rising glen of quite a different shape from the deep, powerfully modelled peripheral glens which we had lately travelled through. For it was broad and open and surrounded by relatively low mountains, consisting for by far the greatest part of disintegration products. Hard rock cropped out at intervals only along the foot of the mountains. The broad and level valley bottom bore plain indications of being sometimes filled with water. On the sheltered side



of suitable spurs small dunes, 1 m. at the highest, have not infrequently been formed. They owe their origin to the prevailing westerly wind, but never get an opportunity to grow to a considerable height. The existing circumstances of conformation and relief point to the fact, that they have now certainly reached their greatest possible



Fig. 405. LOOKING NW FROM CAMP III.



Fig. 406. LOOKING SE FROM CAMP III.

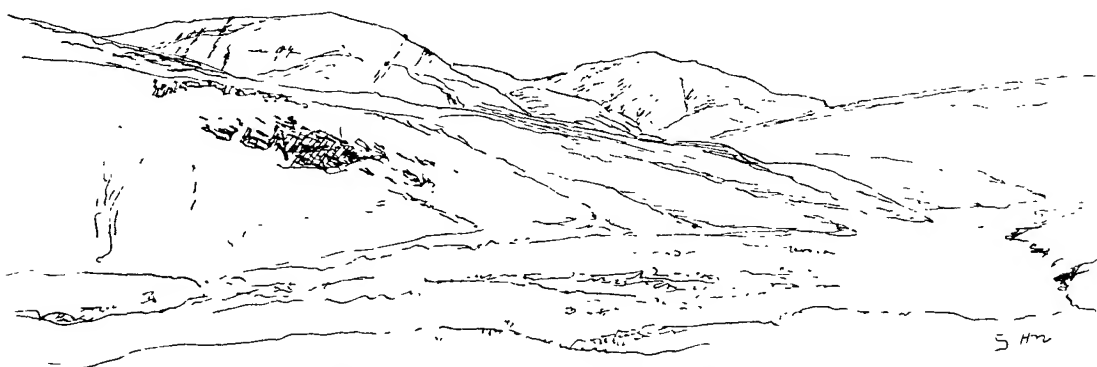


Fig. 407. LOOKING SSE FROM CAMP IV.

dimensions. If by any chance they do succeed in rising above their present altitude, the next hard wind will certainly reduce them to their normal size. The sand-accumulations would appear to be characteristic of the transitional country between the peripheral regions and the plateau-land both in Tibet and in Pamir: for I observed a similar phenomenon in the eastern Pamir at Naghara-kum, west of the Sarik-kol range.

The higher we climbed the finer became the gravel, until finally its place was taken by coarse sand. Black schists still predominated. The glen continued to widen out until we saw ahead of us a gigantic gateway formed by two opposing masses of hard red sandstone; but it was only in their upper parts that the bare rock cropped out to daylight; their lower slopes are masked by immense screes of stones. Here the glen which we had hitherto followed ceased to be distinct, the country south-east of the «gateway» being still more open. According to the investigations of Dutreuil de Rhins and Grenard I have made a mistake in taking this *thalweg* for the upper part of the Kara-muran; in point of fact it is only a side-glen coming from the south and joining the actual main glen of the Kara-muran. Here we had relatively low ranges. Camp II was situated at an altitude of 4703 m. From the altitudes that I have already quoted it is evident that the Tibetan highlands rise in this quarter much more steeply than they do, for instance, at Tatlik-bulak and Tscharklik-su.



Fig. 408. LOOKING NNE FROM CAMP IV.

On 9th August we rode towards the east-south-east across gently undulating country. The nearest elevations had a relative altitude of only 20 to 30 m. and consisted of fine gravel. They may indeed be regarded as the ruins, the last sur-

living fragments, of former mountain-ranges and their ramifications. The surface was strewn with fine disintegrated material, then moist after the last fall of snow. In the north-east and south there were however ranges of considerable altitude, the former being ramifications of the Astin-tagh, the latter northern spurs of the Arka-tagh. The nearest hills were built up of red sandstone. After that we had on our right a minor range, while on the left we passed a small lake a couple of hundred meters in diameter and situated at an altitude of 4945 m. From it issued a stream that goes to feed the Kara-muran, though we were unable to see the latter, it flowing to the north of our route. For the time being this small lake was without efferent drainage and its water consequently slightly salt.



Fig. 409. LOOKING S FROM CAMP V.

With the object of crossing over the little crest which we had hitherto had on our right hand, we entered a minor glen leading towards the south-east and south-south-east. In its entrance the rock was red sandstone; after that the predominating variety was a black, greatly weathered schist. Out of several smaller ranges that we then crossed over the highest reached an altitude of 5109 m. The

eroded watercourses which run down from them towards the south-east do not belong, as I then believed, to the Tschertschen-darja, but to the Kara-muran; this is quite evident from the discoveries made by the French expedition. Camp III was situated at an altitude of 5054 m.

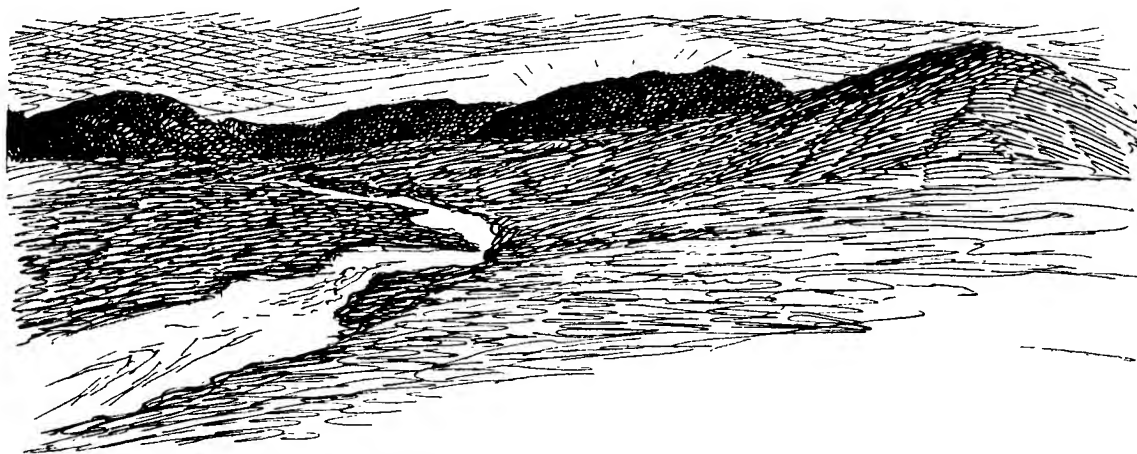


Fig. 410. LOOKING W FROM CAMP V.

On the 10th August we travelled down the little glen in which we had encamped; it terminated in a gently undulating plain. Outside the entrance to this glen, and immediately east of our route, stood a peculiar detached mountain, built up of red sandstone and red clay-slate, the whole capped with a horizontal, rather thick layer of blue-black tuff, full of vesicles, which had subsequently become filled with some white mineral substance. All round the base of the mountain were blocks of tuff which had fallen from the summit; and all the way on after that similar fragments occurred at intervals. Otherwise clay-slate predominated. The capping of tuff has protected the underlying sandstone, so that this mountain is now higher than all its neighbours. The accompanying illustration (fig. 411) will give an idea of its appearance.

On the south side of this mountain there is a large watercourse running towards the north-east; evidently it goes to join the Kara-muran, but was at that moment dry. The flat region we were then travelling along, a high plateau between the Astin-tagh and the Arka-tagh, is dimpled with a number of smaller depressions, some containing water, others without; these latter are generally covered with a layer of white salt. But for considerable distances the country is practically level.



Fig. 411.

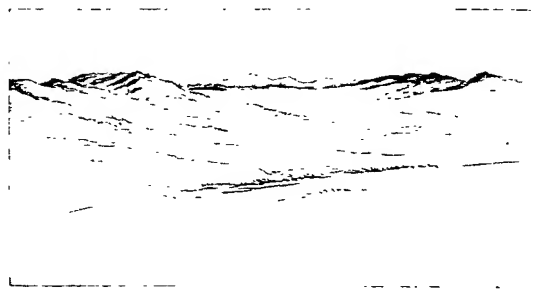


Fig. 412. ARKA-TAGH LOOKING E. AUG. 12.

The stretches of hills which encircle this high plain are relatively low; I do not think I saw snow or glaciers anywhere. After that on our way south we crossed over three low ridges, all extending from east-north-east to west-south-west and separated from one another by insignificant latitudinal valleys. About 5 km. to the west-south-west we perceived a not inconsiderable lake. Grazing was rare and scanty, and only once did we pass a spring. It is the presence of springs that determines the site of encampments. Camp IV had an altitude of 4988 m.



Fig. 413. LOOKING E FROM CAMP V.

On 12th August we inclined more and more towards the east, and climbed over a spur of the mountains by means of a pass 5060 m. high. There we found red, close-grained limestone, and this rock continued to predominate during the rest of the day. Over on the southern side of the pass we descended into a larger main glen, which comes down from the west-south-west and proceeds east. This is bordered on the north by the crest which we had just climbed over, and on the south is likewise bounded by low hills. It afforded us an extensive view towards the east, as

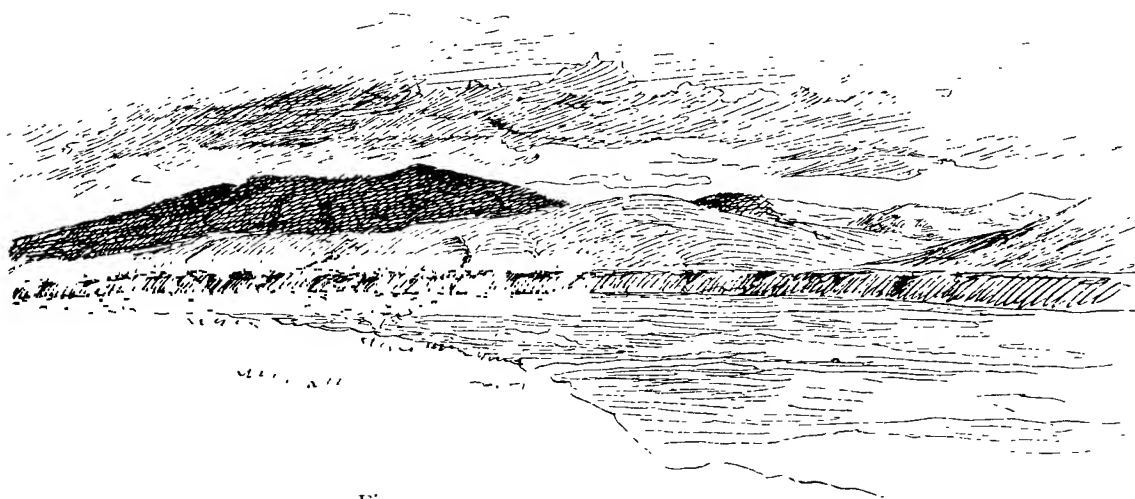


Fig. 414. LOOKING N FROM CAMP VI.

far as the snowy mass of the Arka-tagh in the far distance. This glen also, which at that time carried no water, belongs no doubt to the system of the Kara-muran. From the south it is joined by several side-glen; one of them, 130 m. broad at its entrance, possessed a tiny brook. Its shape suggested plainly, that sometimes this little torrent must swell to a big stream. The water which descends by it is thaw-water from the adjacent main range of the Arka-tagh. After that as we marched along the slopes of the mountains on the southern side of the glen we had an ex-

cellent view northwards across the high plain, which stretches away as far as the southern spur of the Tokus-davan. The summit of that range, capped here and there with perpetual snow, stood out sharp and distinct in the pure, clear atmosphere. Camp V stood at an absolute altitude of 4955 m. Thus the vertical differences of altitude were here fairly unimportant. Red sandstone was again the prevailing rock. The water in the brook, beside which we encamped, was also of a brick red colour. Not seldom we had snow, hail, or rain.



Fig. 415 LOOKING NW FROM CAMP VI.

On 15th August we travelled eastwards along a straight, regularly shaped latitudinal valley between two of the subsidiary ranges of the Arka-tagh. On the way we crossed over a transverse glen coming from the south; its watercourse carried at that time a little water, and after traversing the plain it pierces the range on the north and descends to the Kara-muran. To the south we were unable to see the Arka-tagh, though we did see it to the east, the quarter in which the Ullugh-mus-tagh lifts up its great snowy mass. Farther on our latitudinal valley is crossed by yet three other transverse glens coming from the south, the first of the three being rather deeply cut and carrying a volume of  $1\frac{1}{3}$  cub.m. in the second. To the north

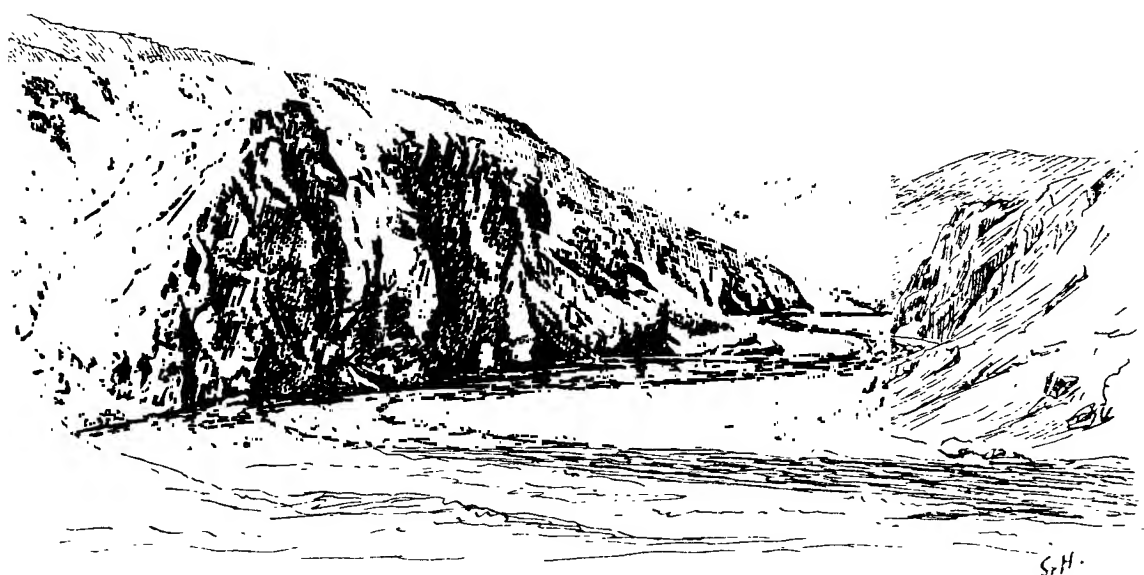


Fig. 416. WHERE THE TWO VALLEYS UNITE; LOOKING NW.

of our latitudinal valley there is another one similar to it, extending east and west, this too bordered by a not inconsiderable range. In point of fact the Arka-tagh is divided here, just as we found it to be a long way farther east, into a system of



Fig. 417. CAMP VIII LOOKING N.



Fig. 418. CAMP VIII LOOKING N 40 W.

parallel ranges. These are pierced by transverse glens, through which flow the streams that arise on the Arka-tagh and proceed north to empty themselves into the Karamuran. Camp VI (alt. 5003 m.) was made in one of these transverse glens, the brook in which carried about 2 cub.m. of water.

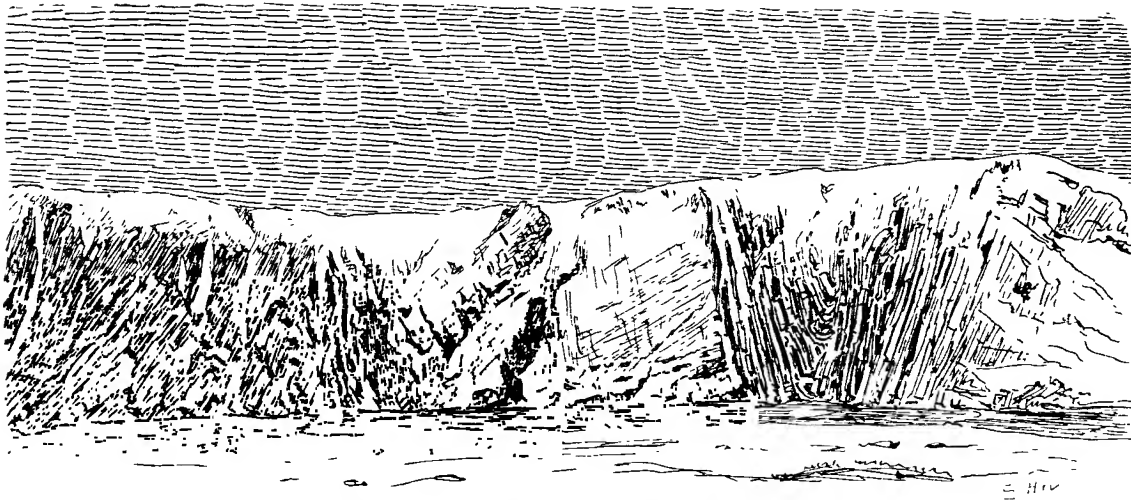


Fig. 419. CAMP VIII LOOKING N 60° E.

On 16th August we still continued our journey east along the same latitudinal valley, crossing over a couple of glens and streams from the south. Probably all these transverse glens converge into one or two large glens before they join the Kara-muran. Our latitudinal valley sloped gently upwards towards the east; the altitude of its upper part, an insignificant water-divide, amounted to 5039 m. Here a little lake sometimes forms. East of that extremely flat threshold the country again opens out into a plain that inclines gently towards the north-east, and is bordered on the north by the range which we had hitherto had on our left hand. Here all the streams from the south unite into a large glen, which cuts through the last-mentioned range. Passing this glen on our left hand we proceeded up a side-glen running towards the east-south-east and having massive ranges on both sides of it. The one on the north, close to the foot of which the valley watercourse clings, is very steep, often indeed precipitous, and consists of green schist dipping 35° towards the N. 45° E. The southern range on the other hand has a more gradual slope,



Fig. 420. CAMP VIII LOOKING SE.



and sends down several side-glens. There was here barely 1 cub.m. in the stream in the principal glen. Penetrating up a glen that came down from the south-east, we again approached a water-divide. On the whole we found here the same orographical architecture as farther east, namely a system of latitudinal valleys every one of which contains several thresholds acting as water-divides, from which the streams flow principally east and west, until they enter some larger transverse glen that carries them through the northern ranges. The only difference is that, in the western part of the highlands between the Astin-tagh and the Arka-tagh, all these streams, equally whether they go to join the Kara-muran or the Tschertschen-darja, eventually find their way down into the East Turkestan lowlands; while farther east they flow some to the Atschik-köl and some to the Kum-köl, and consequently still remain within the real domain of the highlands. Camp VII was pitched in the extreme upper end of a little transverse glen at the considerable altitude of 5291 m. The pass itself, which we had shortly before crossed over, had an altitude of 5302 m. What forced us to stop in that inhospitable and unpropitious region was a furious hail-storm. South and south-west rose in insuperable chaos the culminating summit of the Arka-tagh, crowned with snow-fields. Nevertheless even in these lofty regions soft disintegrated material is predominant, and hard rock is found only on the summits of the ranges or at their bases, where erosion has exposed it.



Fig. 421. CAMP IX.

The next day we proceeded east along a latitudinal valley, which runs in line with and forms the continuation of the preceding latitudinal valley; it too is inclosed between vast mountain-ranges, but itself inclines towards the east. From the south it is joined by a series of side-glens, all of which then carried a little water. By this means the river that courses down the main valley gradually swelled into a pretty considerable stream. Indeed it may be taken as the rule in these mountains, that virtually all the tributary streams flow down from the south; on the other hand from the ranges which border the latitudinal valleys on the north but little or no water descends. Further, it may be observed that the range on the northern side of each latitudinal valley has a steep slope towards the south, and that the eroded watercourse which drains the valley clings closely to its foot. On the other hand the northern slope of the southern range has a gentle fall: in the matter of altitude these southern ranges are always the highest. All this is quite true with regard to the valley down which we were then marching.



Farther on this is joined by a side-glen from the south, which emerges out of two great mountain-peaks in part covered with snow. The stream that coursed down it has carved a deep channel for itself between steep gravel-and-shingle terraces. In order to avoid these, for they are frequently gashed by difficult ravines, we were forced to march along the bed of the stream, which occasionally widened out to a couple of hundred meters. Farther on the bed is cut down to a depth of 20 to 25 m. through the green schists. Finally, after making a sharp turn, almost at right angles, the river pierces the northern range, the green rock of which is there exposed at several points. Right on the elbow thus made rises a round-topped mountain, the sides of which are scored by numerous ravines. Meanwhile our latitudinal valley continued its way towards the east, though now sloping upwards in that direction. It also contained a brook of 1<sup>1</sup>/<sub>3</sub> cub.m., which therefore unites with that which we had recently followed, and consequently with it breaks through the northern range. We pitched Camp VIII close to the confluence of the two at an altitude of 5055 m. Littledale also encamped close to the same spot, likewise touched by Dutreuil de Rhins and Grenard. But while from this point both the French and the English expedition travelled south-east in order to scale the Arka-tagh by means of a pass which Grenard calls the »southern pass of the Kara-muran» (alt. 5578 m.), I continued east-south-east along the above-mentioned latitudinal valley, and then crossed over the Arka-tagh by another and somewhat lower pass.

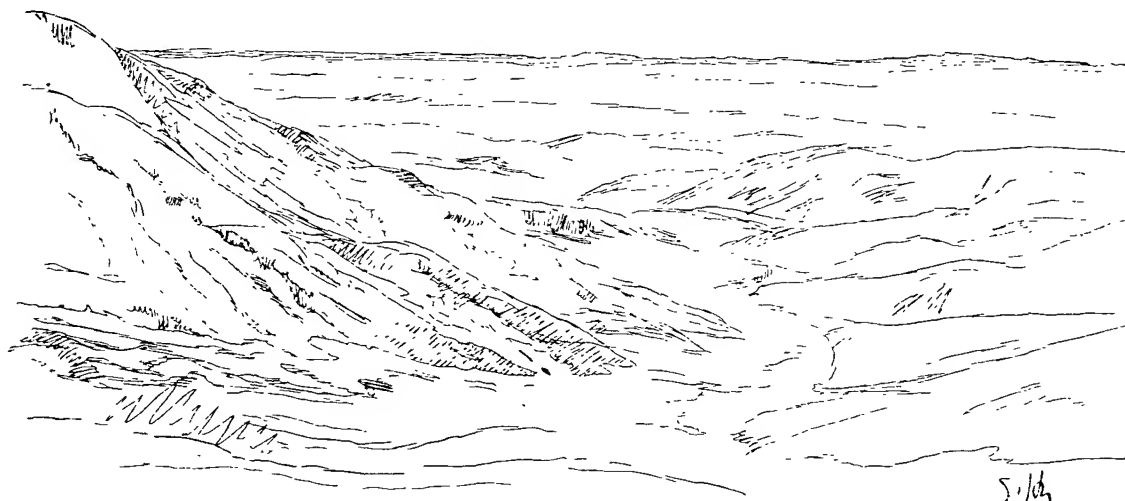


Fig. 422. LOOKING S FROM THE ARKA-TAGH PASS.

Everywhere in the neighbourhood of Camp VIII we saw a greatly weathered dark schist, alternating with beds of varying thickness, fine-grained and crystalline, though some of it was soft and readily split into flakes as thin as paper. These rocks were beautifully exposed in the escarpments of the eroded watercourse, 10 to 12 m. high. The illustrations (figs. 417—420) give an idea of the appearance of this glen. At noon on 18th August the united stream had a volume of 6.3 cub.m., but was still rising, and towards evening it reached its maximum. The wind was blowing from the north-west. Every day it snowed and hailed, but the nights were generally bright.

On 22nd August we did a short stage up the eastern glen to Camp IX (alt. 5086 m.). Next day the glen narrowed at first. The channel down which its stream flows meanders backwards and forwards from one side to the other. But later on it again widens out to a trough-shaped arena, into which tributaries gather from all directions. Looking up through some of these glen-openings, we saw the main crest of Arka-tagh to the south. Having crossed over this relatively open arena, we continued up a large side-glen that took us to the south-east. The rock still consisted of schist of different kinds and in different positions. The glen soon contracted, and led up to a secondary pass at an altitude of 5544 m., one of the very highest that I have climbed over. Here my guides, who were Taghliks, led me astray, for we might have avoided the pass. We pitched Camp X in the glen that leads down on the north side of the pass, the altitude of which was 5362 m.

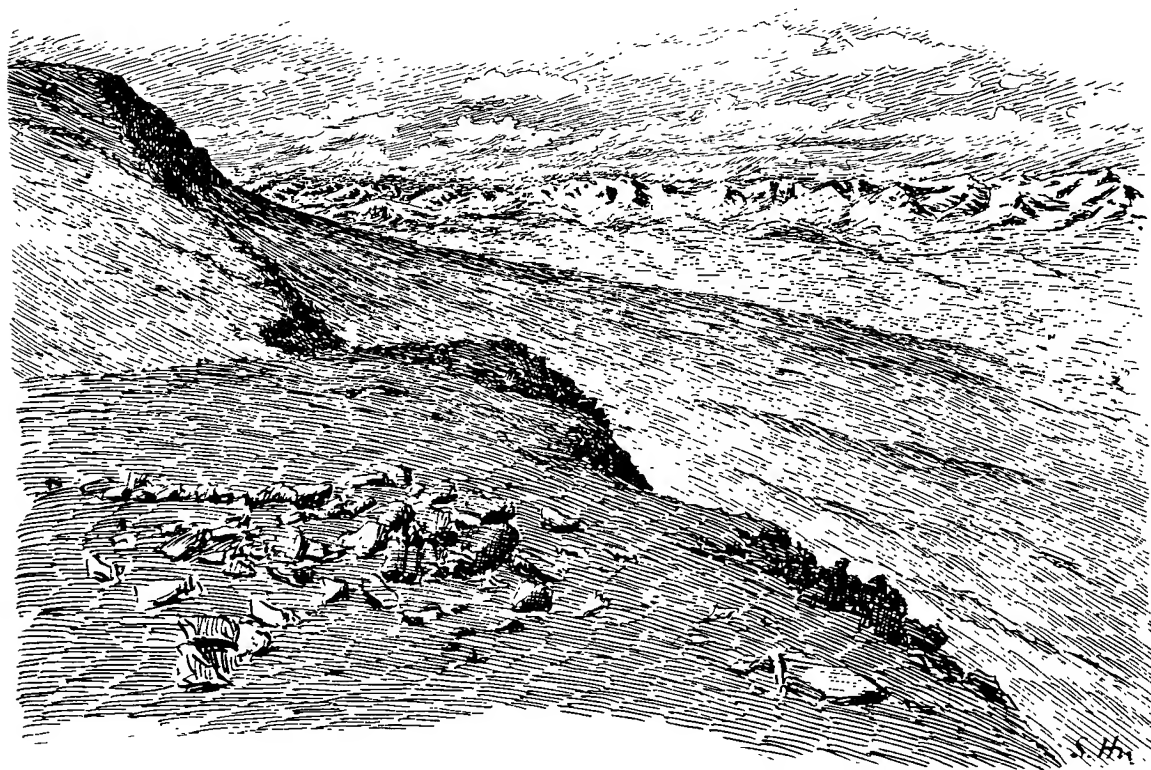


Fig. 423. LOOKING N 30° W FROM THE LITTLE TUFF MOUNTAIN AT CAMP XI.

At length on August 24th by following a little glen to the south-east we were able to get over the Arka-tagh. The pass by which we accomplished this was easy and very rounded, and reached an altitude of 5521 m. It was strewn with fine schistose gravel; but there were only a couple of very trifling thresholds of hard rock, dipping  $27^{\circ}$  towards the S.  $30^{\circ}$  E. The pass was free from snow, although most of the mountains in the neighbourhood were lightly capped with it. Both east and west of the actual pass the summits of the Arka-tagh rise but a trifling degree higher. The southward-going glen was at first steep, but it soon debouched upon the great latitudinal valley that runs along the southern foot of the Arka-tagh,

and the spurs by which the little glen is bounded are likewise short. To the south the view is limited by a flat and relatively low range, extending both east and west for as far as we were able to see. In the S.  $10^{\circ}$  W. we perceived a small lake, into which all the brooks of the vicinity gather, the lake being probably identical with Dutreuil de Rhins's Lac de Corbeaux. This was the first self-contained basin with which we came into contact in the great latitudinal valley. We next marched across a surface that inclines gently towards the south-east, crossing as we did so several small brooks that issue from a vast swelling of the Arka-tagh. This range rose to the south-east and had often been visible during the preceding days. The swelling just alluded to is the Ullugh-mus-tagh, which reaches according to Grenard an altitude of 7360 m. The name also is due to him; I confess I never heard it



Fig. 424. LOOKING NE FROM CAMP XI.

though it sounds likely enough. On the southern face of the great mass we perceived several short glacier arms, all of them almost completely snowed up. All the brooks which flow down from the southern shoulder of this mountain-mass make their way into the lake just mentioned. To the south-west were the remains of former parallel ranges, now for the most part planed away. Where the ground consisted of fine disintegrated matter, it was soft and wet; but where it was gravelly it bore us well. At Camp. XI (alt. 5095 m.) our brook inclined towards the south-south-west. Here there was a small butte of the usual schistose rock, capped with a sheet of tuff about 5 m. thick. With regard to the specimens which I took here Dr H. Bäckström reports, that they »schwarze, blasige, zum Teil glasige, eustatitführende Andesite sind; sie bestehen teilweise aus Stücken, welche aus festen Lavaströmen zu stammen scheinen, teilweise sind es rundliche, blasige Stücke, welche wie vulkanische

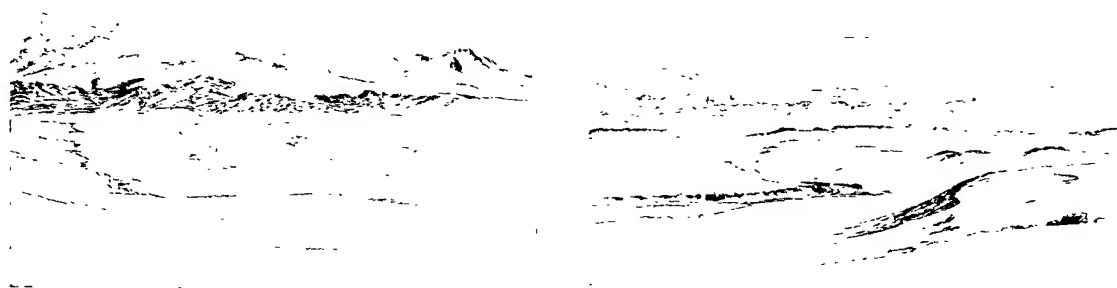


Fig. 425. LOOKING N  $20^{\circ}$  E FROM CAMP XI. Fig. 426. TUFF MOUNTAINS SOUTH OF ARKA-TAGH.

Auswürflinge aussehen». Anyway there exist in this part of northern Tibet numerous signs of former volcanic activity, although it is improper to speak, as Bonvalot does, of active volcanoes. From Camp XI we saw to the south-south-west two similar small buttes, and the black line on their flat-topped summits showed that they too were capped with tuff (see fig. 426).

August 25th. Still travelling south-east we crossed over three little glacier streams containing water as bright as crystal; these came from the Ullugh-mus-tagh and make their way into the little lake mentioned above. Their channels are not very deeply incised. The surface over which they flow consists of extremely finely divided detritus, which was then wet and sodden. This was the first time I had experience of that particular sort of ground, which is so especially characteristic of high Tibet. Soil and mud are washed down from off the surrounding mountains, which are already severely denuded, and gradually fill up the flat self-contained drainage-basins. In summer the ground is kept constantly moist by the precipitation, but in the winter it is frozen. At all events the strongest tempests that blow are powerless to lift it; all the disintegrated material is therefore of necessity detained in the basins into which it is carried down.

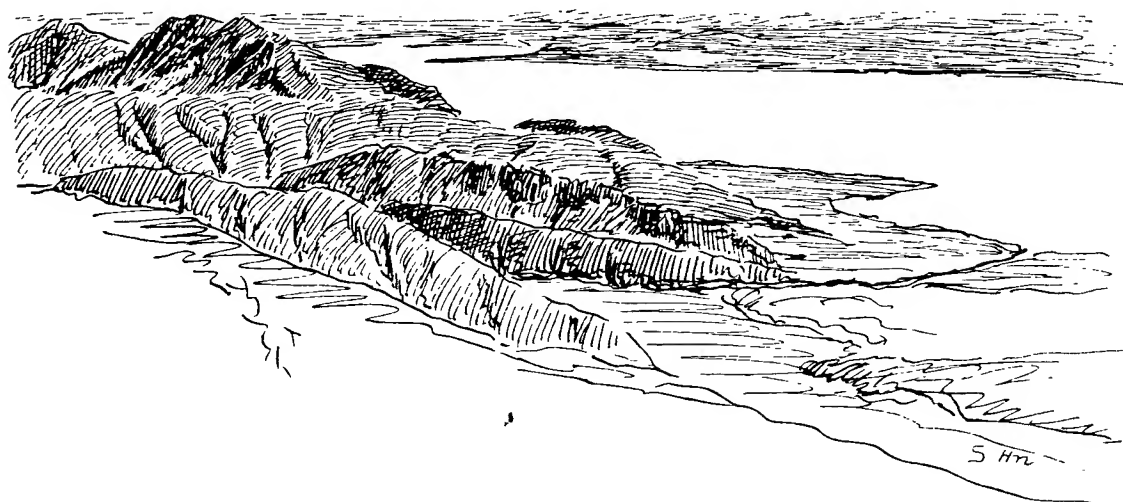


Fig. 427. LOOKING SE FROM CAMP XII.

After getting over an inconspicuous water-divide, we approached a small salt lake, containing clear green water, contributed by several brooks coming from the south-west. I have called this lake No. I and have also used Roman numerals to indicate the succeeding lakes that we found in this latitudinal valley. On the north side of lake No. I there is a small tuff-crowned butte of the usual appearance. After that the ground was much broken, our route running transversely across a system of ridges, between which small glens make their way east-north-east into an insignificant lake. Here the schist had a dip of  $23^{\circ}$  towards the S. Occasionally there was some short grass. After crossing over yet another small water-divide we forded a larger stream, carrying a volume of about 5 cub.m. in the second and emptying into the western part of salt lake No. II, which stretches east and west. Its southern shore is flat and is dotted with three small lakes. Our camp here had an altitude of 4911 m. and stood about 5 m. above the level of the lake.

On 27th August we continued towards the east-south-east along the northern shore of the lake. The little mountain-chain on that side consists of hard, green, finely crystalline schist, dipping  $27^{\circ}$  towards the N.  $10^{\circ}$  E. Its gravelly scree juts out a long way into the lake, which appeared to be shallow. The gravelly ground alongside the lake was hard. This lake is fed by several small brooks and water-courses, some with deltas, others without. In some places small dunes of coarse sand had formed, a phenomenon rather rare, so far as our experience goes, in Tibet. At its eastern extremity, where it is very narrow, the lake is entered by a stream with muddy red water; and its delta consists of red mud. The lake generally is

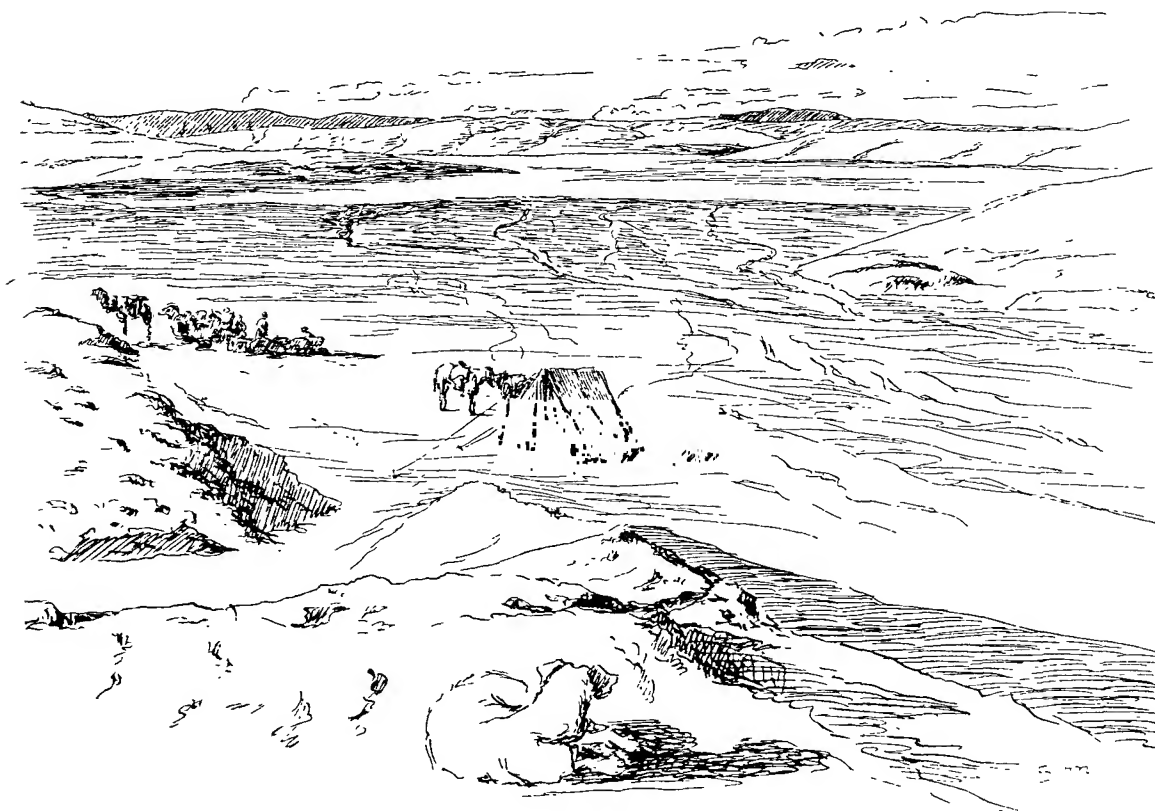


Fig. 428. CAMP XIV LOOKING N; WITH LAKE NO: IV IN THE BACKGROUND.

of a pure blue-green colour, but its eastern bay is befouled by the red stream. Here again the rock was a red, greatly weathered sandstone. Crystallized gypsum occurred in this place, as so often elsewhere in these regions. as a filling of dykes. After that we travelled along the latitudinal valley, which rises gently towards the east and is drained by a stream that, after picking up several tributaries especially from the south-east, enters lake No. II. At Camp XIII (alt. 4898 m.) we found some grass, the first we had seen all day. Of the Arka-tagh and of the range on the south, the continuation of the Koko-schili, we did not see much, as they were for the most part masked by foothills and subsidiary offshoots. The southern range possessed far less snow than the Arka-tagh. The southern versant of the latter, which is composed of a chaos of crests and ramifications of the main range, is



Fig. 429. CUMULUS CLOUDS; LOOKING SE FROM CAMP XIV.

drained by several small brooks that find their way into the salt lake. The great latitudinal valley which we were following, and which constitutes such a striking and characteristic morphological and orographical feature, is itself no doubt divided into a number of minor latitudinal valleys, some containing lakes, others not, but all as a rule drawn out east and west. The country is monotonous, our route traversing a whole series of self-contained drainage-basins, all in external appearance rather like

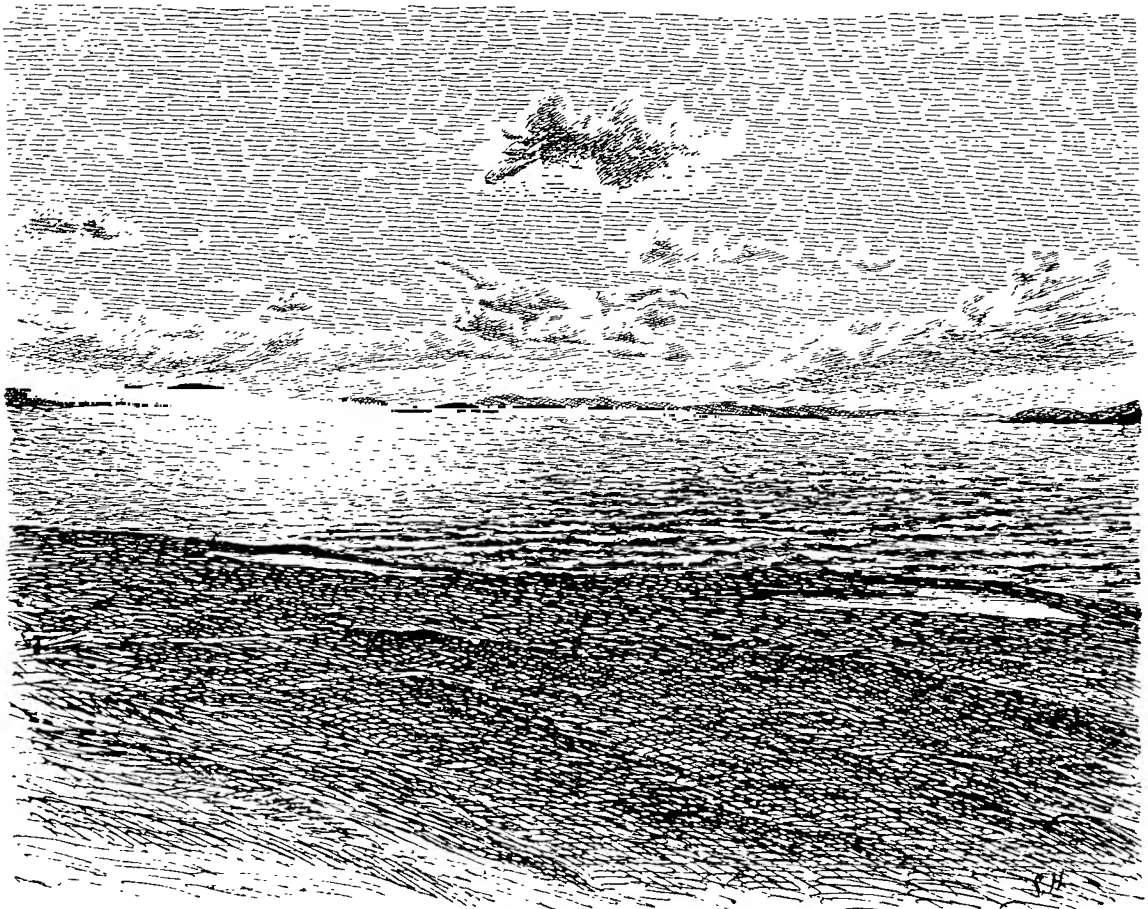


Fig. 430. LAKE NO. V; LOOKING W FROM CAMP XV.



one another. It proved impossible for me to make out where my routes of 1900 and 1901 crossed the route which I followed in 1896, and on the general map which accompanies this work, it has only been found possible to have regard to the actual itinerary itself.

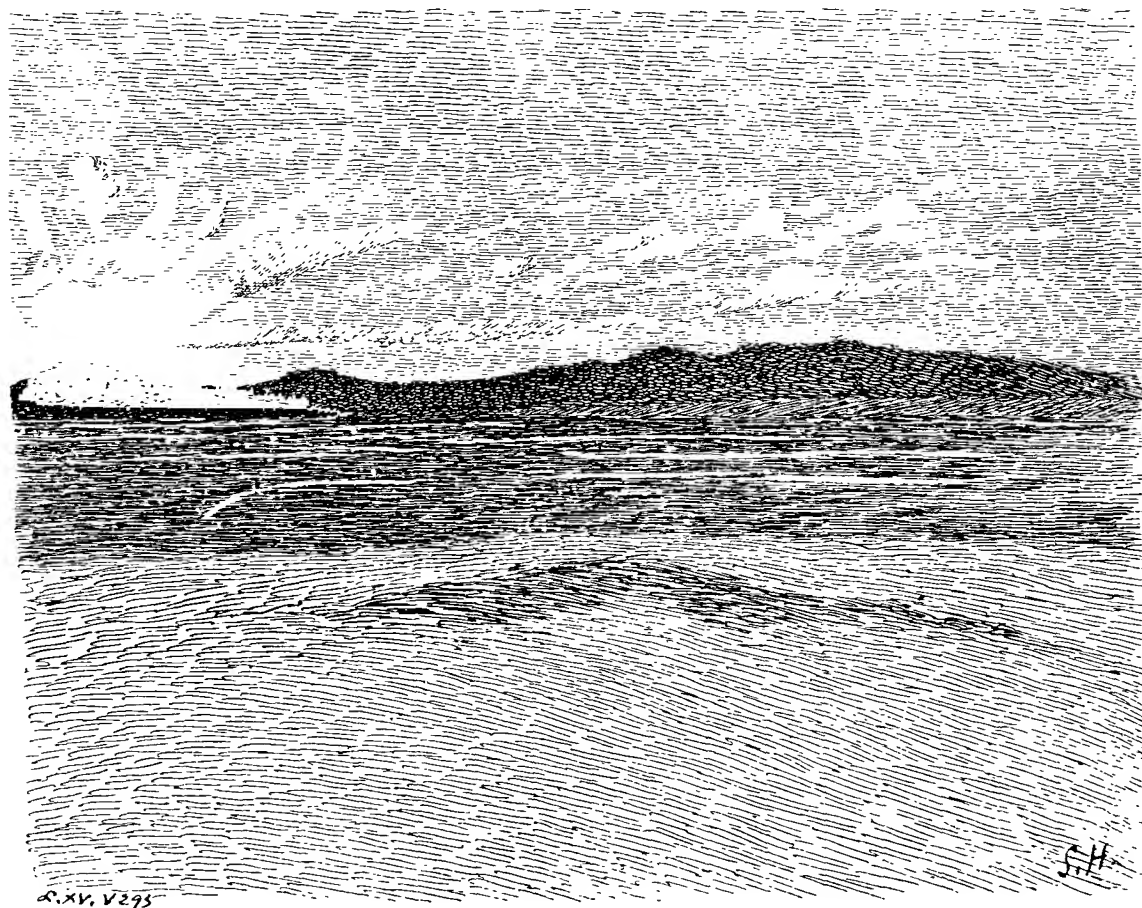


Fig. 431. LOOKING NW FROM CAMP XV.

Next day we kept on the whole to the same level throughout, and traversed several small self-contained basins with miniature lakes. One of these, although it occupied the lowest depression in a self-contained basin, contained fresh water. The highest point of the march, a flat threshold that serves as a water-divide between two similar basins, had an altitude of 5026 m., while our Camp XIV stood at 4968 m.

On 29th August soon after starting we passed various small basins, then a flat water-divide, on the east side of which we found a broad and spacious glen issuing from the mountains on the south. This runs first towards the north, but soon describes a sweeping curve towards the east. Then, having crossed over a low ridge, we struck a brook flowing eastwards towards lake No. V: but this we soon passed, leaving it on the north. The same lake likewise receives several small rivulets issuing out of the southern foothills of the range along the northern face of

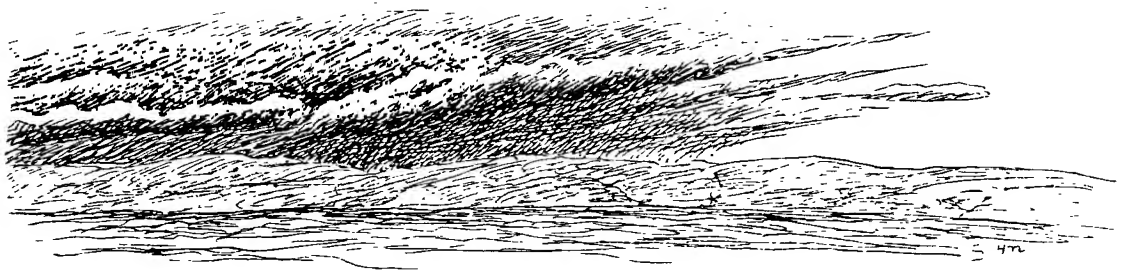


Fig. 432. LOOKING N FROM CAMP XVIII.

which we were marching. Farther on we were separated from the lake by a small ridge. After that we passed to the south a little salt lake (No. VI), with two bays stretching a long way towards the east. Camp. XV was made beside a larger river, which arrived from the east and at that spot picked up a considerable tributary from the north. To the north-east appeared a confused tangle of mountains, offshoots and ramifying arms of the Arka-tagh. The mountains in the vicinity of Camp XV (alt. 4947 m.) were relatively low, and consisted of powdery disintegrated material. There was a little grass, and kulans were numerous. The river beside which we were encamped empties into a lagoon at the eastern end of lake No. V. This lake was intensely salt, and as a consequence of the violent westerly wind that was blowing the salt water had been driven into the lagoon and into the excessively flat mud delta of the river. At the eastern end of the lake there was a rampart of gravel, heaped up by the beat of the waves and possibly also by ice, and on the inside of the rampart were several elongated pools. We also easily made out marks according to which the water formerly reached a height of 2 m. This can hardly mean that the lake is actually shrinking, for the marks we observed may just as well have been caused by a relatively high level having been reached not long before. It is possible too that the level of these flat lakes varies with the season, that is to say, they rise in the summer, but subside again in the autumn, when the snows cease to melt on the surrounding mountains, and the precipitation comes down for the greater part in a non-liquid form.



Fig. 433. LOOKING NE FROM CAMP XVIII.

August 31st. The principal brook at Camp XV comes from the south-east and flows close past lake No. VII, which itself is entered by a limpid stream from



the north-east, originating in the glaciers of the Arka-tagh. This lake is quite small and contains fresh water, so that it is probably provided with an underground effluent to lake No. V. The next two lakes, Nos. VIII and IX, both lie in the prolongation of the latitudinal valley and are the recipients of several small brooks. The surface was undulating; and probably there are smaller parallel valleys on the other side of the heights which rose nearest to our route. The southern range, which was here nearer to us than the northern range, possesses a couple of vast snowy masses, which nourish a large stream that empties itself into lake No X. Our Camp XVI, in the vicinity of this lake, had an altitude of 4950 m.

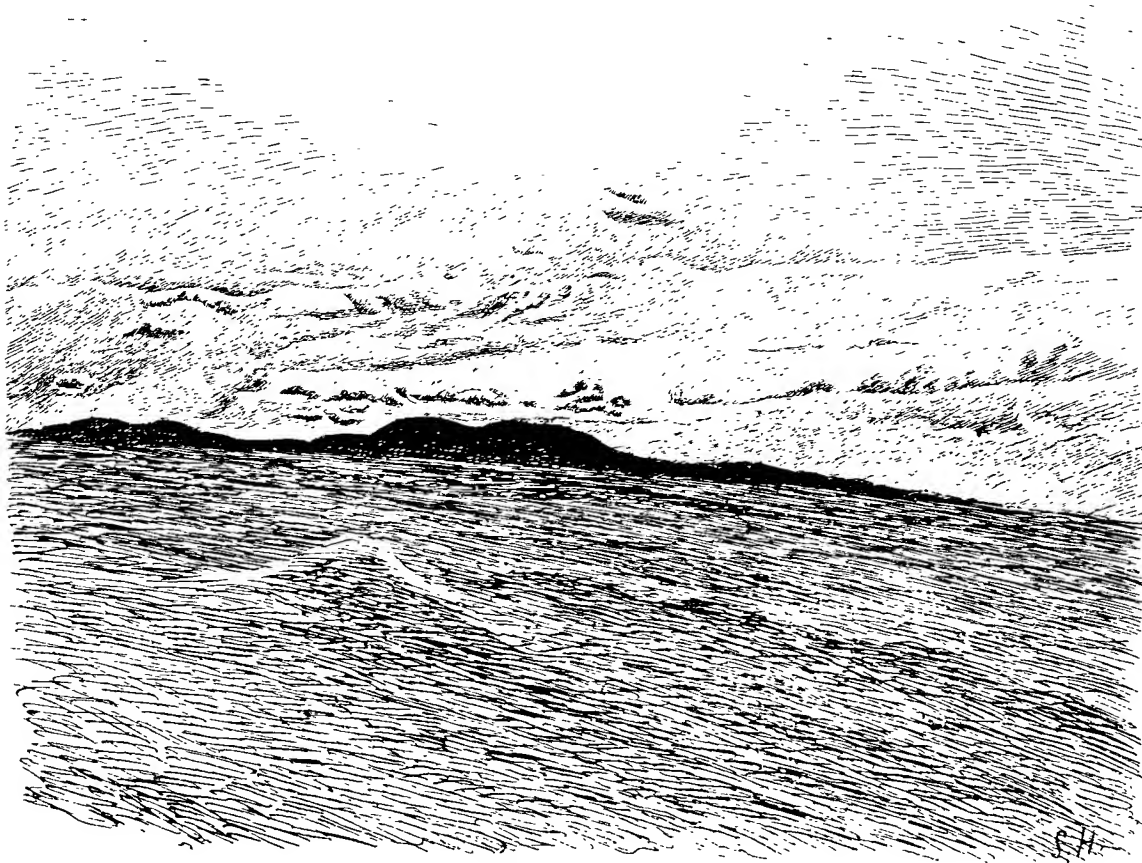


Fig. 434. LOOKING W FROM CAMP XVIII.

On September 1st the direction of our march was east-south-east. We did not travel along the lowest part of the latitudinal valley, but kept to the very flat slopes, often to the eye perfectly level, of the southern mountains. In this way we passed lake No. XI lying several kilometers to the north, on our left. This lake is the gathering basin of numerous brooks, which then carried a combined volume of about 5 cub. m. in the second, and derive their water from the melting of the snows on the southern range. In this, fairly close to us, was a vast mass covered with snow and possibly also with glaciers; close beside it is the peak D of which I took

the bearings. At that same point the range appears to project towards the north, for both east and west of the peak D it recedes farther to the south. Immediately north of that peak the ground is plentifully strewn with pieces of black tuff. In the neighbourhood of Camp XVII (5073 m.) there were any number of yaks and orongo antelopes.



Fig. 435. A PART OF KING OSCAR'S MOUNT.

During the course of our march on 2nd September we crossed over Prince Henri d'Orléans and Bonvalot's route (1889—90) in the vicinity of the little lake No. XII. They travelled west of a detached, snow-covered, round-topped mountain (E), and there was no difficulty in fixing the point of intersection of our route with theirs owing to some rubbish that we found and the droppings of their camels. Moreover one of my men had also accompanied them, and he recognised the place again. The altitude of lake No. XIV was 5078 m. It is entered by several brooks and spring-fed streams, but the level of the lake would appear to be fairly constant, and as its water was perfectly fresh, it probably at a certain level possesses an invisible outlet. Its shores were boggy and treacherous; although generally speaking the surface in this part of northern Tibet is often strewn with gravel, and consequently hard. This is true however of the slopes only, for as a rule the surface down below is soft, and consists of the finest dust. The occurrence generally of fragments of tuff is characteristic, and often the pieces are rounded and polished, like cannon-balls. They are of course fragments from such tuff layers as those which we so frequently saw capping the isolated sandstone mountains.

From lake No. XIV a broad valley, without any distinct watercourse, slopes down towards the east, to lake No. XV. In that valley there are however marshes and springs, which possibly owe their origin to the former of these two lakes. From Camp. XIX (alt. 4985 m.) we saw to the S.  $54^{\circ}$  E. a big massive snowy mountain, belonging to the main range on the south which I called King Oscar's Mount. It was indeed covered with snow two-thirds of the way down from the top; on its northern face the snow-line ran then at about 5300 m., and its absolute snow-line is no doubt somewhat higher.

The greater part of our stage on 6th September lay along the northern shore of lake No XV, which is narrow and as usual elongated east and west and very salt. In its western part there appear to be springs at the bottom, for even in calm weather the water there was all aboil and in a state of eddy. Along the southern shore runs a relatively rather low range, with a gap in it indicative of a pass. North of the lake there is a chain of schistose rocks, pierced at intervals by transverse glens, the brooks of which festoon the lake shore. Sometimes the mountains fall so steeply into the lake, that we were forced to ride in the water when keeping to the abrasion terrace. The Arka-tagh was masked by this ridge; but the southern range was clearly and distinctly unfolded, without any masking by subsidiary foothills. At the eastern end of the lake there were rudimentary dunes built up of exceptionally coarse-grained sand. They were not more than 1 dm. high, so that they had the appearance merely of slight waves. They stretched north and south, and turned their steeper faces towards the east, for in that locality the prevailing wind blows from the west. The altitude of lake No. XV was 4896 m., that of Camp XX, a little farther east, 4915 m. A brook enters the lake from the east.

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## CHAPTER XXXII.

### ALONG THE SOUTHERN FOOT OF THE ARKA-TAGH.

Hitherto we had travelled through a series of large latitudinal valleys, broken up into a countless number of small self-contained basins with next to no vertical differences of altitude; now however we appeared to be approaching a region in which not only the basins, but also their lakes, are larger. In fact it may be laid down as a rule, that both the self-contained basins and their lakes increase in size from west to east; though this law is far less pronounced in the latitudinal valley down which Wellby and Malcolm travelled. On 7th September we marched over the flat threshold which separates the two lake-basins Nos. XV and XVI; the altitude of the threshold was 5116 m. We reached the threshold by following up the brook which empties itself into the first-mentioned lake, and which is embraced between distinctly marked terraced banks. The ground was soft, although it had a thin sprinkling of gravel resting upon a substratum of fine soil. The streams come from the south, from rather imposing mountain-masses, mantled with snow-covered glaciers. Upon reaching the threshold just mentioned they divide, some making their way into lake No. XV, others into lake No. XVI. The latter received about  $2\frac{1}{2}$  cub.m. in the second from the mountain-mass I; this was the main stream, and on its bank we pitched Camp XXI at an altitude of 4988 m. To the east-north-east rose a vast snowy mass of the Arka-tagh, which now made its appearance again, though it was generally difficult to make out the positions of its peaks owing to their being enveloped in clouds.

On 8th September we followed the left bank of the main stream. Its eroded terraces are fairly distinct and bear evidence that sometimes a considerable volume must flow down that way, a circumstance easily accounted for by the propinquity of the snowy mountains on both north and south. It receives more particularly from the Arka-tagh several not inconsiderable streams of very muddy water, an indication that they have their origins in glaciers. Consequently the main stream gradually swells into a river of some magnitude, which finally empties itself into the extreme western end of lake No. XVI.

We kept along the foot of the range that rises on the northern side of the stream; the space intervening between our route and the existing river-bank is not

infrequently occupied by marshes and lagoons, fed by springs that gush out at the foot of the mountains. It would require only a very slight rise of the existing level of the lake for it to flood this flat moist strip of ground. And that it really does flood it sometimes appears evident from the fact, that several of the marginal lagoons are encircled by rings of white salt. The mountain-range which we had immediately on our left consisted of the usual schists, and the ground was covered with their detritus, although intermingled with pieces of tuff. Dunes of fine sand had gathered at a projecting promontory. One brook, rather bigger in size, was fenced in on the left by an eroded terrace 3 m. high. From that point we perceived C, and D, summits of the Arka-tagh, almost due east. On the southern shore of the lake are relatively low ridges, and behind them rises the great snowy mass of the southern range.

Similar conditions obtain on the northern shore of the eastern part of the lake. The mountains slope gently down towards it, and the lake is shallow. Here too we found various small saltwater lagoons, together with a strip of salt, several meters broad, close along the shore. This is of course a clear proof, that the lake level does oscillate at different seasons of the year. In another place however we perceived amongst the loose gravel very distinctly marked beach-lines, which belong to quite a different category. One of these was  $2\frac{1}{2}$  m., the other  $3\frac{1}{2}$  m., above the existing level of the lake. It is however impossible to tell what is the range of volume of the lake between maximum and minimum; but it is probable that in July, when the snows are melting fastest, the water will be higher and the lake bigger than in the beginning of September, and that the saltwater lagoons, which are now cut off from the lake, will then in any case be entirely under water. More particularly the river which enters the lake from the west will at that season (July) carry down very considerable quantities of water. But on the other hand it would of course be absurd to suppose, that the beach-line at  $3\frac{1}{2}$  m., which I have just mentioned, is a mark of the range of the oscillations within the course of a single year. It is more reasonable to regard them as old beach-lines, mementos of a time when the lake had a more extensive area than it has now, and when, it is fair to assume, the precipitation was more abundant. It is pure accident, that the beach-lines remain so distinct just at that particular spot, while in other places they have been broken down; for some reason or other they happen to have been better protected. Generally speaking, it was very seldom that I had an opportunity of establishing the existence of beach-lines in this North Tibetan latitudinal valley. The basins that the lakes fill are so flat and shallow, and the beach-lines are demarcated with so little distinctness, that as a rule they seldom have any opportunity to leave behind them either distinguishable marks or abrasion terraces. The lakes in the central, southern, and western parts of Tibet are very different in character; for they frequently possess steep shores, so that the beat of the surf is able to concentrate its energy upon a line and does not dissipate it over a surface as in the lakes of Northern Tibet.

Camp XXII stood at the same altitude as the lake, namely 4947 m. Close beside the former a pier-like projection shot out into the lake for about 2 km., pointing towards the east and terminating in a point. It was only a few meters

broad and a couple of decimeters high. The lagoon or bay thus inclosed is entered by a brook, and it is no doubt the sedimentary matter that it brings down which has given occasion to the origination of the pier-like tongue of land. On its inner side it possesses as it were a couple of barb-like projections, both likewise pointing to the east. Shore formations of this nature are characteristic of the lakes in this part of Tibet, although it is seldom that they are so beautifully developed as in this particular instance. They are generally found on the east side of the mouth of a river or brook; so that it is evident they derive their material from the sediment brought down by the stream, and the fact of their pointing to the east will be somehow connected with the prevailing westerly wind: it is natural to think of an eastward flow of the surface layers of the lake water.

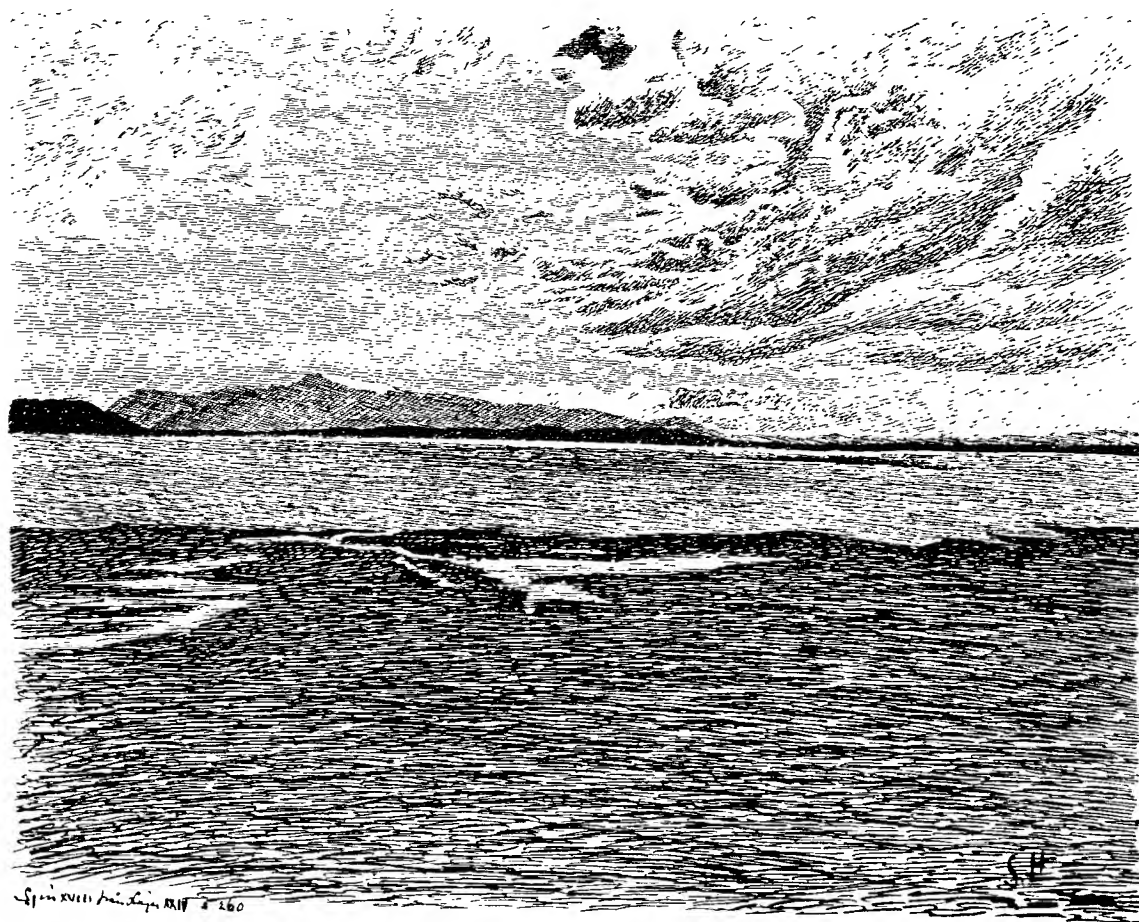


Fig. 436. LAKE N:O XVIII, LOOKING WSW FROM CAMP XXIV.

On 9th September we passed the rounded eastern end of the lake, where the ground, consisting of sediment and schor, was hard. Here the lake is entered by a muddy brook, with a volume of about 2<sup>1</sup>/<sub>2</sub> cub.m. in the second, and no doubt having its origin in the huge swelling of the Arka-tagh which is crowned by the peaks C, and D, and on which we observed a few short glacier arms. The form generally assumed by the culminating summits of the mountain-ranges in this part of

Tibet is that of a flat, rounded swelling, and in consequence of this the ice-formations shape themselves into a mantle, a breastplate, or a flat cap, from which lappets and skirts project at intervals, while on the other hand the peculiar long narrow type of glaciers that are characteristic of the Alps have no opportunity to develop.

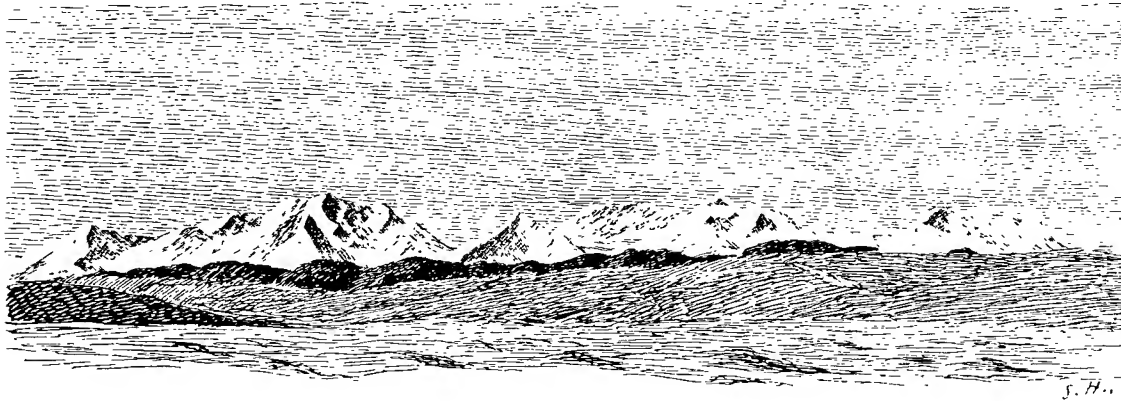


Fig. 437. LOOKING NNW FROM CAMP XXV; SUMMITS I, AND J, OF THE ARKA-TAGH.

Continuing our journey towards the east-south-east, along the foot of the mountain-mass C,—D., we ascended towards the threshold that bounds the basin of salt lake No. XVI on the east, passing on the way yet another series of brooks that flow down from the glacier region, and are all destined for the lake last mentioned. The divide between lakes Nos. XVI and XVII had an altitude of 5099 m. The latter lake, which is small — we passed it at some distance to the south — gathers into itself all the brooks of the locality, even those that flow down off the vast swelling of the Arka-tagh; on the other hand all the watercourses that come down off the southern range were dry, notwithstanding that opposite to the lake that range likewise rises into a mass of some magnitude. The altitude of Camp XXIII was 5013 m. Animal life was poor, the country being to all intents and purposes quite barren.

On 10th September we forded at the beginning of our day's march an exceptionally large glacier stream (volume, 6 to 7 cub.m. in the second), proceeding from the peak H, in the Arka-tagh, situated east of and quite close to the peaks which I have last mentioned. This stream too was bound for lake No. XVII. And now appeared in the north-east a whole series of snowy peaks; the Arka-tagh makes there a sharply accentuated crest, of far greater dimensions than the southern range and absolutely impassable.

After that the surface became, at any rate to the eye, practically quite level. The brooks that we crossed over flowed south-east towards the next lake, No. XVIII, which we saw in the far distance like a faint blue line. The beds of these watercourses are very shallow and indistinct, and appear frequently to change their course,



Fig. 438. LOOKING S FROM CAMP XXV.

and so contribute to the levelling up of the basin. The ground, where dry, was hard and easy for marching on, but soft and boggy where moist. The finely pulverised material of which it consists was originally glacier clay, brought down by the numerous streams that flow off the mountains to the north. Camp XXIV, close to the shore of lake No. XVIII, had an altitude of 4920 m.

This lake was the largest we had hitherto seen in this latitudinal valley, namely some 40 km. long, though only 8 to 9 km. broad. Like all the lakes in our latitudinal valley it stretches from east to west. Its water was less salt than that of the preceding lakes, but was as bright as crystal and of the most glorious green and ultramarine blue colour, the latter indicating the deepest parts. Along the shore is a strip of sediment; but except for that the ground is strewn with fine schistose detritus, with light pieces of porous slag or tuff of a reddish colour.

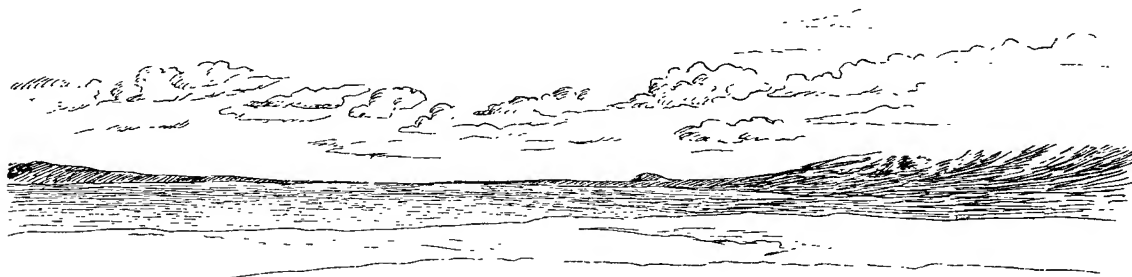


Fig. 439. LAKE XIX; LOOKING E FROM CAMP XXVII.

The mountains on the northern shore are spurs of the mass I, J, of the Arka-tagh, and often leave free next to the lake a rather narrow strip of shore, though sometimes they or their detritus screes reach all the way down to the shore-line. In the same mountain-mass originate the brooks that we crossed over. On the prolongation of one of these spurs there has been formed a triangular peninsula, with a small detached eminence in the middle of it; nevertheless the peninsula is so low at its neck as to favour the formation of a lagoon. At intervals along the northern shore there are small islands; islands however are rare in these lakes. For a pretty considerable distance the outline of the lake is rather irregular, being diversified by a number of peninsulas, islets, bays and lagoons. Three small promontories projecting towards the south-east form so many continuations of the hills on the shore and at the extreme tip of each is a small island.

The temperature fell now to a minimum of  $-12.6^{\circ}$  and of a morning all the freshwater lagoons were frozen over, while tiny pieces of ice were floating on the brooks. Under what circumstances these lakes become ice-bound is not easy to ascertain. Any lake that is not saltier than lake No. XVIII will certainly freeze, although by reason of its size, and probably its relatively great depth, it will be late before it does so. Moreover the freezing of all these lakes will be retarded by the violent westerly winds, which sweep across them unhindered. The different lakes will freeze at different times, according to their depth, extent, salinity, and their greater or less exposure.



On 13th September we travelled towards the south-east, keeping first along the eastern shore of the lake, then striking away from it and crossing over various brooks that issue out of the Arka-tagh. After surmounting a threshold 5085 m. high, we went down into a smaller basin (5023 m.) containing a freshwater pool. In this region the only vegetation to be found was moss.

Immediately east of Camp XXVI began a brook, which we followed all day on the 14th September towards the east and east-north-east; this is joined by several tributaries from the range on the south. Here the character of the latitudinal valley is particularly well developed. The surface was boggy and treacherous in consequence of the snowfall of the past few days, the snow having melted and penetrated into the ground. The only exception to this was on the northern slopes of the southern range, where the snow did remain all day. Our brook gradually swelled until it carried a volume of 3 cub.m.; it empties into the western end of lake No. XIX, forming a typical delta. Camp XXVII by the lake-side had an altitude of 4802 m., so that we had now reached relatively lower parts of the latitudinal valley. On the northern shore is a subsidiary and parallel range of the Arka-tagh, reaching its culmination in the peak N<sub>7</sub>. To the north-north-east was the conspicuous peak M<sub>7</sub> of the Arka-tagh.

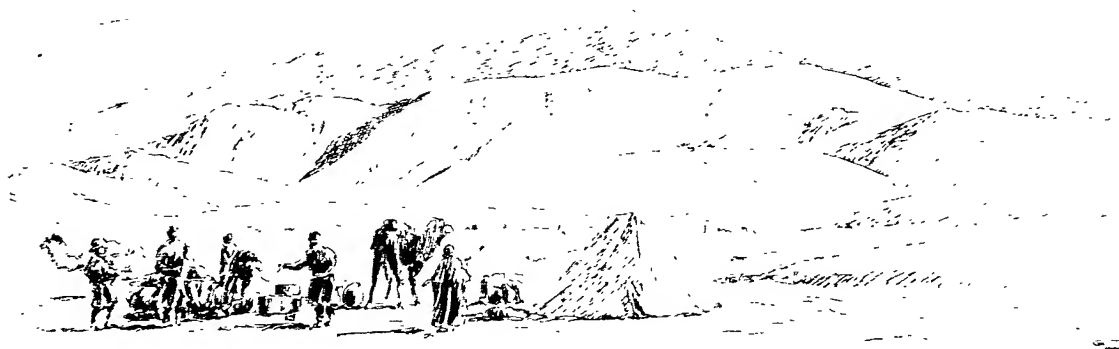


Fig. 440. MOUNT W AS SEEN FROM CAMP XXIX.

On 16th September we travelled along the southern shore of lake No. XIX. The ground was composed alternately of gravel, sand, and dust, with scattered patches of moss. Here, as also beside several of the preceding lakes, marmots and gulls were common. This lake is fed by several brooks of clear water flowing down off the range of medium elevation on the south; the biggest of them carried a volume of 3 to 4 cub.m. We formed Camp XXVIII immediately north of peaks U and V at an altitude of 4875 m.

September 18th. Beyond the lake to the east the middle of the latitudinal valley is filled with marshes and boggy swamps; for this reason we thought it better to keep to the slopes of the southern range, where the ground was firmer. These slopes are seamed by a great number of brooks, all of which terminate in the swamps below; the biggest of them carried a volume of 1 cub.m. When you see all these countless torrents streaming down the sides of the mountains that inclose each successive self-contained basin, and converging upon its central depression, and

find that even thus late in the autumn they sweep down not inconsiderable quantities of water, and when you further reflect how much greater the quantity must be during the height of the summer, then you can no longer feel any astonishment at the peculiar relief which this highland valley offers with such stereotyped uniformity. Everywhere flat, extremely rounded outlines, the country frequently appearing to the eye quite horizontal, forming a chain of shallow saucer-like depressions, the concavity of which is so slight that the differences of vertical depth are almost inconceivably small, and indeed the basins themselves appear to be well on the way to getting filled up entirely with solid material. In the bottoms of the brooks there is fine gravel, but elsewhere it is all powdery dust; hard rock is nowhere visible.

I suspect, that on the other side of the range which borders the last lake on the north, and after that continues farther towards the east, there exists a latitudinal valley parallel to that along which we were marching. The Arka-tagh still towered up mighty and dominating, the peak P, being especially conspicuous. We were now so close to the Koko-schili, the range on the south, that its summit was hidden behind its lower spurs and offshoots. As a rule it may be said that the streams which gather off the southern mountains into every self-contained drainage-basin carry down far smaller quantities of water than those which come from the north. Moreover the crest of the Koko-schili grows manifestly lower towards the east. Camp XXIX had an altitude of 4772 m., so that it stood lower than lake No. XIX, from which it was separated by an imperceptible threshold.

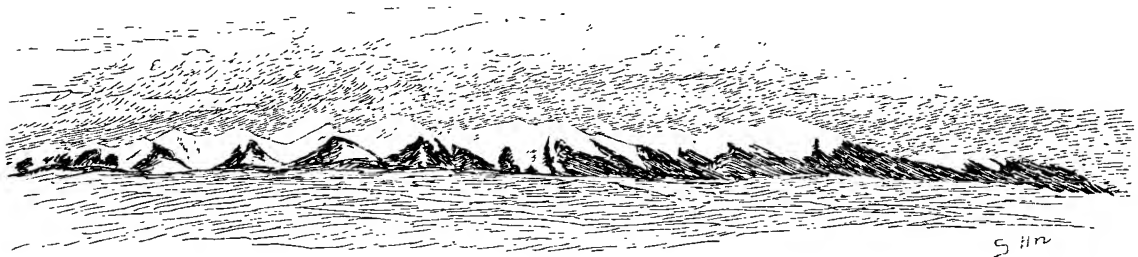


Fig. 441. LOOKING NE FROM CAMP XXX. THE ARKA-TAGH.

On the whole the rainfall in September was more abundant than in August, and the farther we advanced to the east the more frequently did it snow. For the downfall no longer came in the shape of hail or rain, as it did in the western half of the latitudinal valley, but in the shape of snow, either hard and pebbly, or fine and powdery. Whilst on our way to Tengri-nor in the beginning of August we had noticed signs of the beginning of the rainy season; and no doubt the same conditions prevail in this respect throughout the whole of the Tibetan highlands, though in the more northerly parts the season will be a little later, and there too the rainy season is not so sharply defined as it is in the south. On the other hand the quantity of precipitation is far less abundant in the north than in the south, owing to the fact that each successive range that the moisture-laden clouds pass over on their way northwards exacts its tribute from them. The rain-clouds always come from the west and north-west, even though the wind on the surface of the earth

may be blowing from the east. But even as early as the second half of September the uppermost layer of the earth froze every night to the depth of one or two centimeters, though it quickly thawed again next day. And owing to the strong insolation this would continue to be the case for a month to come, and only then would the ground be definitively frozen so hard as to defy the power of insolation to thaw it. At Camp XXIX, while the temperature of the air was  $3.6^{\circ}$ , that of the ground at a depth of 21 cm. was  $2.9^{\circ}$ , and at a depth of 88 cm.  $0.4^{\circ}$ .

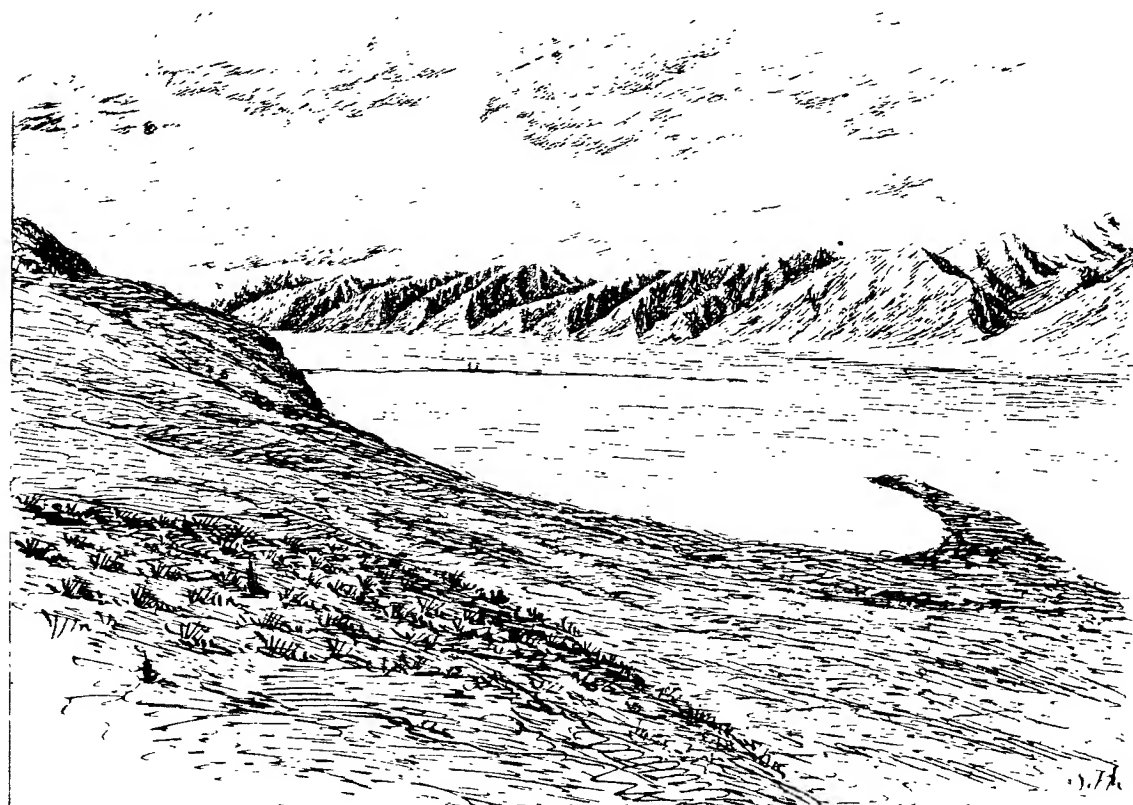


Fig. 442. LAKE XX AS SEEN TOWARDS THE WNW FROM CAMP XXXI.

On 20th September we marched north-east diagonally across the latitudinal valley, fording several small brooks, the water of which flowed under thin sheets of ice down into lake No. XIX. Thus we had once more reached a threshold, and its altitude was 4863 m. At length we came across hard rock in a watercourse, namely a green, finely crystalline schist, dipping  $59^{\circ}$  N. This water-divide afforded an extensive view. The Arka-tagh was here rather lower than hitherto, and bore relatively little snow; and on its southern side the main range is flanked by a confused jumble of rounded heights, built up of yellow friable earth and covered with a little moss. The threshold of which I have just spoken separates lake No. XIX from lake No. XX. The descent from it towards the north-east is relatively steep, and by the time we reached Camp XXX we had got down to an altitude of 4596

m. In this case we may indeed speak legitimately of a transverse threshold across the great latitudinal valley; and on the east it descends by successive steps, though the height of each step is insignificant. Faunal life was represented by yaks, kulans, marmots, and ravens.



Fig. 443. THE SAME TOWARDS THE ENE.

The river, beside which we were encamped, appeared to gather its waters from over a considerable area of the slopes of the Koko-schili. At the point where we forded it, it had the appearance of being the biggest stream that we had yet seen south of the Arka-tagh. Its breadth was 22 m., mean depth 0.6 m., mean velocity 1 m., and volume 13 cub. m. in the second, and yet we crossed it at the period of the day when its flood is wont to be the smallest. Fresh marks on its eroded terraced banks showed plainly that quite recently it had indeed been twice as big. The river-valley is inclosed between two parallel ranges, which did not appear to have any direct connection with the main ranges; the one to the north was the larger. Hard rock cropped out pretty frequently; it consisted of schists, which split into slabs, and its dip was  $74^{\circ}$  towards the N.  $20^{\circ}$  E.

We travelled down beside this river; but leaving its delta at some distance to the east, and skirting the western end of the lake, we began to look for a pass across the Arka-tagh. It was high time we crossed it in search of the Mongols,

for we had lost the greater part of our horses and camels in this inhospitable country, in which the grazing was so wretchedly thin. Our Camp XXX on the shore of this lake stood at an altitude of 4555 m., and that too was the altitude of the lake. This was the biggest lake we had seen in the latitudinal valley, and like the valley it stretches from west-north-west to east-south-east. Its water was intensely salt, and of a pure dark-blue colour, pointing to a great depth, and this too is rendered probable by the differences of altitude, which are greater in this part of the latitudinal valley than they are in its western parts.



Fig. 444. THE SAME TOWARDS THE ESE.

On September 22nd we travelled along the southern shore of the lake towards the west-north-west. The mountain-chain, which had bordered on the north the river-valley I have just mentioned, came here to an end; the spurs and slopes that reach down from its black craggy crest, almost destitute of snow, to the very edge of the water, thrust each a "toe" as it were into the lake. Between them are eroded glens, deep cut and mostly without water. This made it hard work riding, and put me in mind of the country known as Jäti-tschap at the northern foot of the Kwen-lun. We formed Camp XXXI in the vicinity of a narrow pier-like projection of the shore. Except for this the shore-line is tolerably regular.

At the foot of the mountains there is a flat strip of land and this increases in breadth towards the west; it is strewn with fine schistose detritus, in which two ramparts were distinguishable 1 to 2 m. above the then existing level of the lake. Probably this may be taken as an indication that the lake is actually shrinking. Between these two ramparts, which run faithfully parallel to the outline of the lake, there are a number of lagoons, some containing water, others dry, and all with fine sediment in their bottom. All the brooks that find their way into the lake empty themselves first into similar lagoons, and the lagoons, which are always completely separate from the lake, are connected with it by underground emissaries. The water in the lagoons is perfectly fresh.



Fig. 445. LOOKING EAST FROM A POINT NEAR THE WESTERN END OF LAKE NO: XX; THE ONSET OF A STORM.

Finally the lake narrows to a point in the west. There it is entered by a brook, which at that time carried a volume of only 1 cub.m. It comes from that particular latitudinal valley which forms the west-north-westward continuation of the lake, or rather, to speak more correctly, the valley which drains eastward down to lake No. XX. This latitudinal valley is bounded on the north first by the Arka-tagh, possessing there a couple of dominating peaks, and secondly by the recently mentioned chain that terminates at the lake. The spurs of the Arka-tagh here jut

out southwards one behind the other like the wings of a stage setting, and it was only on these that there were a few strips of snow. The other range may be said to bisect lengthwise the great latitudinal valley between the Arka-tagh and the Koko-schili, dividing it into two parallel valleys.

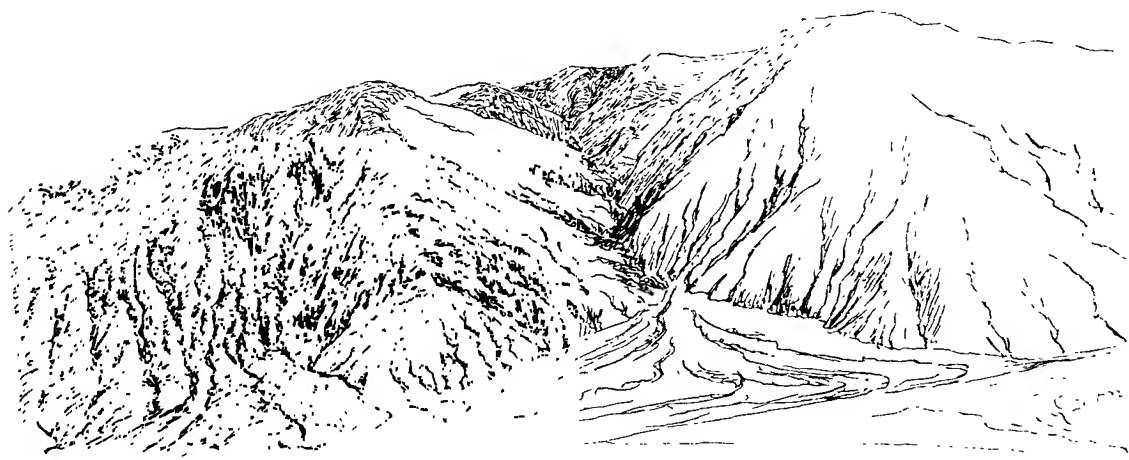


Fig. 446. LOOKING NNE FROM CAMP XXXIII.

Turning our backs upon this lake we travelled north-north-east, marching towards the foot of the Arka-tagh, where we pitched Camp XXXII in the entrance to a glen at an altitude of 4693 m. Here we found again the usual schist, dipping  $23^{\circ}$  towards the N.  $25^{\circ}$  E.; amongst the gravel I observed also granite and mica-schist. However it proved impossible to cross over the Arka-tagh by that particular glen; it was so choked up with stones and gravel, and the approach was altogether too steep.

Accordingly on 23rd September we proceed farther towards the east-south-east along the northern shore of the lake. The surface was pretty undulating, for each spur of the Arka-tagh is continued down to the lake by a chain of hills. The eroded watercourses between them were then dry, and they terminate at the lakeward end in flat delta-shaped screes of gravel and sediment, patterned superficially with the radiating arms of the rivulets of the actual deltas. Camp XXXIII was about 100 m. above the level of the lake. This region abounds in game. During the day it snowed, but it was only on the slopes facing north that the snow remained, while on the southern slopes of the Arka-tagh it melted rapidly.

On 25th September we proceeded farther alongside the lake, keeping one to two kilometers from its shore. The surface undulated a good deal, and the brooks were bigger and carried water. A small pass which we crossed reached an

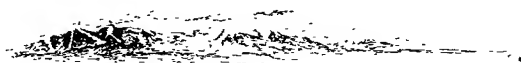


Fig. 447. MOUNT T, LOOKING ENE FROM CAMP XXXIV.

altitude of 4797 m. and consequently was no less than 250 m. above the level of the lake. From it we were able to obtain a pretty comprehensive view. To the north was the sharply outlined impassable crest of the Arka-tagh, with short,



steep, deep transverse glens leading up to it. East stretched to an infinite distance a gently undulating elevated plain, in fact it was the broadest open expanse I had seen in this part of Tibet. At length we perceived the eastern end of the lake, likewise pointed, and beyond that two smaller lakes, Nos. XXI and XXII, all three separated from one another by swellings of the latitudinal valley so flat as to be almost imperceptible to the eye. It was to this point that Carey and Dalgleish penetrated from the north in their memorable journey. After skirting the western and southern shores of lake No. XXI, they turned towards the east, and followed the northern shore of yet another lake, which however I was unable to see owing to our route being at too great a distance from it. That lake is the last in our great latitudinal valley, and appears to be separated by only a very narrow divide from the regions on the east that send their waters down to the sea. For the brooks which, after that, stream down the southern slopes of the Arka-tagh make their way into the river which Rockhill calls the Namchutu-ulan-muren, though Wellby's name for it is Tschumar (see vol. IV). In Wellby's latitudinal valley this river stretches its tentacles a good deal farther west than in my valley. Thus the swelling of the earth's surface which forms the boundary between the central self-contained basins of Tibet and the rivers which discharge into the oceans on the east and south-east of the continent — the divide of which I have spoken above in connection with the Satschu-tsangpo — forms here in this its northernmost extremity (if indeed it does on the whole run meridionally) an extremely irregular line, with deep curves and elbows to both east and west.

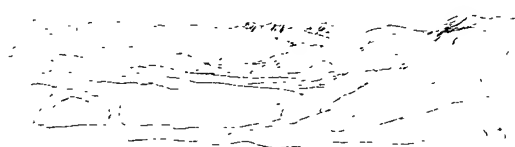


Fig. 448. LOOKING N 23° E FROM THE LAST ARKA-TAGH PASS.



Fig. 449. DEAD WILD YAK.

East of this little threshold we were faced by a wide-open rocky gateway in the Arka-tagh, the entrance to a transverse glen. Round the eastern extremity of the lake stretches a level plain with a thin sprinkling of grass. Here we pitched Camp XXXIV, at an altitude of 4575 m. At that end the lake is probably shallow; its deepest place must no doubt be looked for in its western end or in its middle, where it is more cramped by the mountains. Those which frame it in on the south are foothills of the Koko-schili, for its principal crest was visible at a considerable distance farther south.

There was one peculiarity in connection with these mountains to which I have already alluded, and which showed itself pretty generally in this great latitudinal valley: by reason of the different degrees of warmth in the different strata of the atmosphere, the mountains, when seen at a distance and in a clear atmosphere, appear to hover a little distance above the level ground. In consequence of this



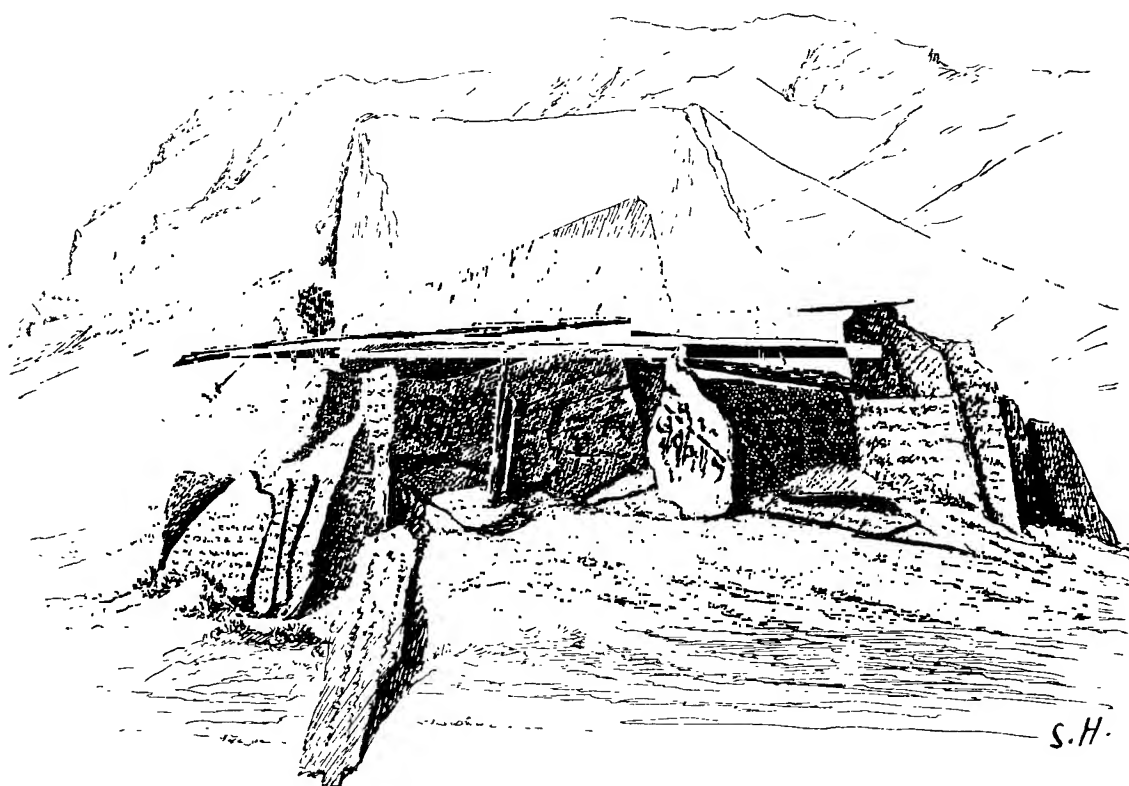


Fig. 450. THE OBO AT CAMP XXXVII.

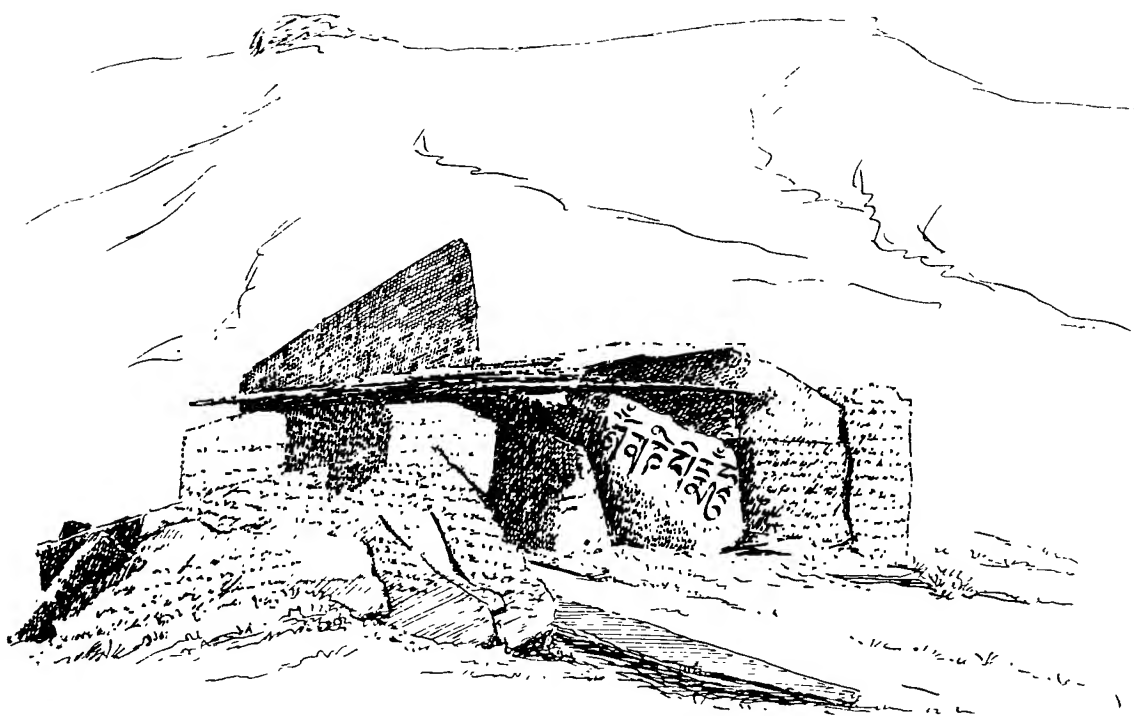


Fig. 451. THE SAME.

also the lakes, which always stretch east and west, appear to be drawn out to an endless length, and the opposite extremity is not visible because the relatively low threshold at that end is entirely obscured by the reflection of the atmosphere. Hence these lakes generally resemble oceanic bays, and we were instinctively led to suppose that each fresh lake that we came to must stretch away to an enormous length.

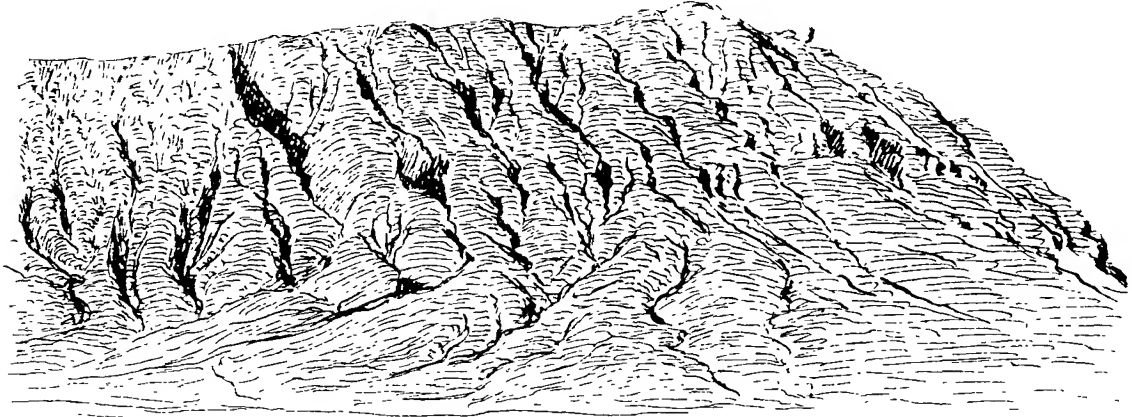


Fig. 452. MOUNT W, LOOKING NE FROM CAMP XXXVI.

We now directed our steps towards the north-east, intending to climb up to the summit of the Arka-tagh by a certain transverse glen. In the entrance to this we found black schist resembling graphite, and having a dip of  $76^{\circ}$  towards the S.  $20^{\circ}$  W. After that we saw nothing more of the open country behind us in which we had been travelling for some six weeks. We were once more in a narrow ascending gorge. The pass however was easy and had an altitude of 4939 m., so that it was considerably lower than all the other passes of the Arka-tagh which I had had experience of farther west. North and north-east were various ranges, though no conspicuous snowy masses. I have no doubt that this is the pass by which Carey and Dalglish crossed. The northern declivity of the pass is steep, but short. In our descent we followed a glen leading north-east between two ramifications of the main range. The glen soon expanded to a breadth of 200 and 300 m., and was joined from right and left by large side-glens; the brook that flowed down it carried 2 cub.m. Yaks and kulans were numerous. Farther down we saw at some distance from our route a little lake, No. XXIII, with an emissary issuing out of it. Camp XXXV was pitched in an extensive, open glen, to the eye almost perfectly level, at an altitude of 4522 m. Thus we were already at a lower level than that of the last lake in the great latitudinal valley we had left. Here it was we came across the first signs of human beings, namely a ruined obo with »mane» slates.

On 29th September we continued towards the north-east, following at first the brook which issues, at all events one of its arms does, out of lake No. XXIII. Its high eroded terraces prove that it can sometimes swell to noteworthy dimensions; at the point where we forded it, it had a muddy torrent of 2.7 cub.m. in the

second. This stream forms one of the head-feeders of the Naidshi-muren, which empties itself into Tsajdam. We left the river at an altitude of 4425 m., and followed a foot-path that led up to a minor pass (alt. 4492 m.), the summit of which was crowned by a cairn of stones. Over on the other side of it was another considerable valley, and its stream, flowing south-east, evidently joins the branch that issues out of lake No. XXIII. It was bordered by better grazing than any we had hitherto seen; and there were vast numbers of kulans and wild yaks, the former in

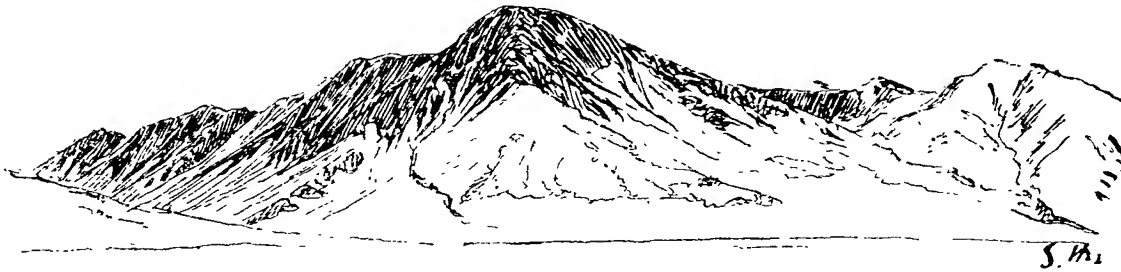


Fig. 453. LOOKING NE FROM CAMP XXXVIII.



Fig. 454. LOOKING N FROM IKE-TSOHAN-NAMEN.



Fig. 455. LOOKING S FROM IKE-TSOHAN-NAMEN.

troops of 200 head. After that we made for an easy pass in the range on the north-east and encamped on its western side at an altitude of 4457 m., beside a sand-dune 6 to 8 m. high, at the foot of which were some small springs. Next morning we crossed over the pass, the altitude of which was 4522 m. It is gentle and convenient, although shut in by stupendous craggy masses, and other glens, running west-north-west and east-south-east are contained between prolongations of the same cliffs. Although a relatively large quantity of drift-sand is heaped up on the western acclivities of the pass, the eastern are on the contrary quite free from it. Indeed it is no uncommon thing to find similar accumulations of drift-sand

on these flat passes in the peripheral regions of high Asia. On this pass the schists dipped  $30^{\circ}$  N. As we now proceeded to travel towards the east-south-east, the range which we had on our left hand was much steeper than that on the right; in the former the heads of the strata crop out at the surface as dark bands or edges, but the latter range has far gentler slopes. Camp XXXVII stood at an altitude of 4399 m., so that we were decidedly reaching lower regions. Here we came across an unusually artistic obo built up of large slabs of slate (see fig. 450 and 451).



Fig. 456. GRANITE CLIFFS ON THE RIGHT SIDE OF THE VALLEY OF IKE-TSOHAN-GOL.

On 1st October we proceeded further down the same valley, which contains yet two other obos. The inscriptions on the slabs that face west are almost obliterated, though on all others they are in a good state of preservation, a clear proof that the prevailing winds come from the west. Immediately after that our glen joins the main glen coming from the S.  $75^{\circ}$  W. The stream in the latter carried 7 cub.m. in the second, and was evidently the same river as that which we forded below Camp XXXV — a confirmation that this was the upper course of the Nadschi-muren (Nadschi-muren or Nadschin-gol). The range on the left side of the united stream at the confluence consists partly of the usual schists, partly of a light-coloured, moderately coarse, muscovitic granite. A little lower down than this we met the first Mongols. They called that locality Mössöto; its altitude was only 4249 m. The river-bed is there inclosed between rather high eroded terraces or escarpments. A round-topped mountain, which rose north of our camp, appeared to consist, so far as we could see, of granite, though the very highest top of all looked like a dark-coloured schist, into which the granite penetrated in the form of intrusive «fingers» and veins.

On 3rd October the river had a volume of about 10 cub.m. Leaving it on our right, we proceeded north-north-east up through the Ike-tsohan-namen, a broad side-glen, in which the mica-schist dipped  $38^{\circ}$  towards the N.  $5^{\circ}$  W. The principal



Fig. 457. LOOKING SSE FROM HARATO.



Fig. 458. MONGOLIAN TENT, TSAJDAM.

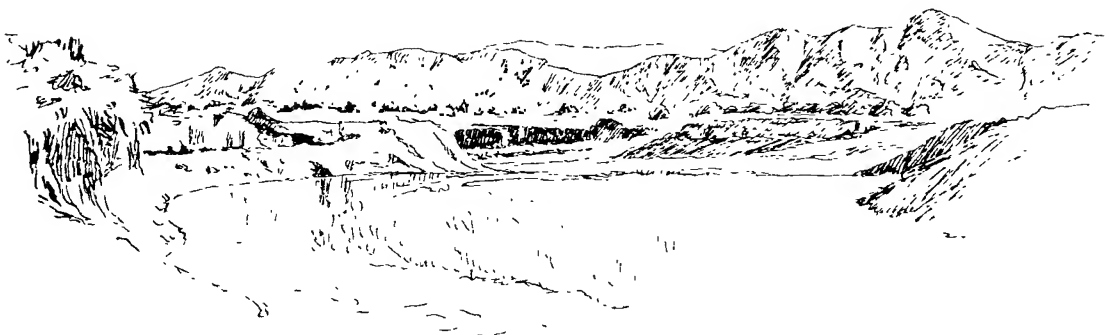


Fig. 459. THE VALLEY OF TENGELIGUIN-GOL, IN TSAJDAM, LOOKING TOWARDS THE MOUNTAINS.

glen runs towards the east, but lower down inclines towards the north, and in a wild, inaccessible transverse glen breaks through the southern border-range of Tsajdam and traverses its plain. The Ike-tsohan-namen leads up to a pass in the main range that forms the westward continuation of the border-range I have just



Fig. 460. THE SAME LOOKING TOWARDS THE PLAINS.

mentioned, the border-range that is pierced by the Naidshin-gol and constitutes one of the parallel chains of the Arka-tagh system. The drainage stream of this glen has cut its bed 10 m. deep through the thick gravel-and-shingle beds. And even at the sides the ground is thickly strewn with sharp-edged disintegration products, gravel, and smaller pieces of stone; but eventually the gravel comes to an end and its place is taken by fine powdery dust. The rock was dark green schist, dipping  $15^{\circ}$  towards the N. Here too for a short distance sand-dunes of a fairly big size have formed on the right or west side of the glen. They climb too a good distance up the mountain-sides, their light yellow colour contrasting sharply against the dark background of the mountain. Our camp beside the Ike-tsohan-namen, close beside a freshwater pool, had an altitude of 4479 m.



Fig. 461. MONGOLIAN JURT, TSAJDAM.

October 4th. Above the camp the glen expands and is joined by several side-glenes from different directions. We followed the main glen up to the pass in the imposing range that now barred our path. The glen again contracts and its bottom is filled with gravel. It contained a tiny frozen brook squeezed in between perpendicular escarpments of gravel-and-shingle, which higher up grow lower and lower, and finally disappear altogether. The rock here was an arcose or feltspathic sandstone. On both sides of the glen the cliffs tower up in rugged, stupendous

masses; the snow lay, but not heavily, on the northern slopes only. During the last stage of our climb our faces were set to the east. Of the passes of Ike-tsohan-davan the eastern one is the higher, namely 4942 m. It is broad and plateau-like, and makes a considerable gap, with lofty masses of rock towering above it on north and south. Here the snow formed a continuous sheet as much as 1 foot deep.

We descended by a glen running east, far steeper than the glen by which we ascended. The contours in this locality showed the powerful modelling of the peripheral regions; but then we were indeed on our way down from the Tibetan plateau to the lowlands of Tsajdam. The snow lay heaped up amongst the gravel,

the quantity here being far greater than on the west side. Strictly speaking the real boundary between the self-contained drainage-area of the plateau of Tibet and the peripheral region that sends its waters down to the great basins of Central Asia is of course the pass in the Arka-tagh which we crossed over north-east of lake No. XX. Consequently the glen of Ike-tsohan-namen belongs to the latter drainage-region; but the characteristic peripheral features do not appear sharply defined until you reach the glen known as Koko-bure, which runs down eastwards from Ike-tsohan-davan. At the point where the glen turns to the north-north-east, the altitude was 4488 m. It has a little brook flowing at the bottom of a deep-cut bed. The mountain-sides which hem it in are for the most part strewn with fine disintegration material. In summer the amount of water that comes down this way is so great that travellers have to ride along a path higher up on the left side of the glen. Here again granite occurred. Our next camp stood at an altitude of only 3898 m.

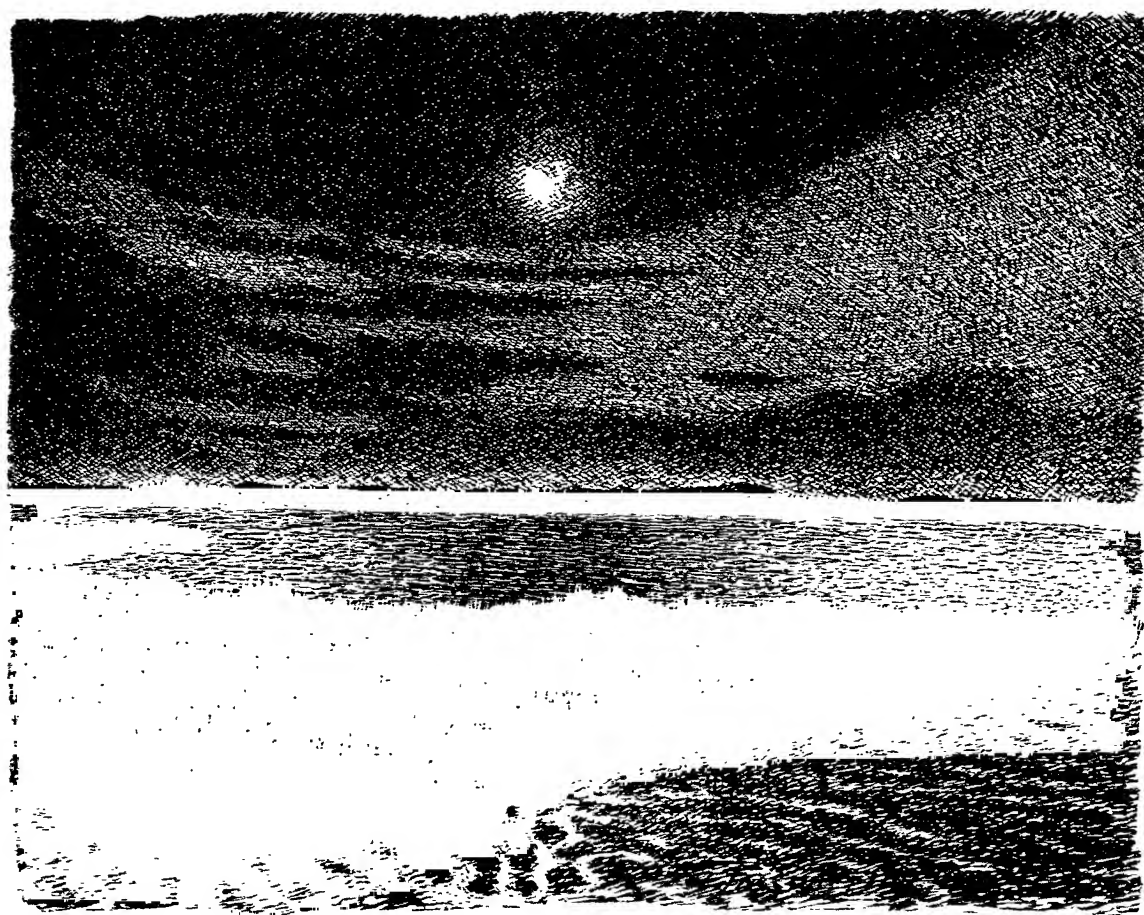


Fig. 462. TOSUN-NOR, LOOKING NE; MOONLIGHT.

On 5th October we continued our way down the glen of Koko-bure, which describes a curve, in that it proceeds first north-east, then north, and finally north-west. Sometimes we rode in the bed of the stream itself, sometimes on the terrace

on its left-hand side, the track being in places deeply trampled in the soft earthy covering, evidence of a lively traffic. The bed of the stream is filled with gravel and stones of all shapes and sizes. From the right our glen is joined by the side-glen of the Bagan-tsohan-gol, that descends from the pass of Bagan-tsohan-davan. On the left rises the towering granitic mass of Särdschin-tombo, across the spurs of which the track runs, and between which are several deep eroded watercourses. The glen gradually expands and the mountains slowly recede, giving room for gently undulating grassy expanses. Several side-glens come down to join it; but the only one that then contained any water was the Bamburtschi-to on the left. Our camp at Harato had an altitude of 3321 m.

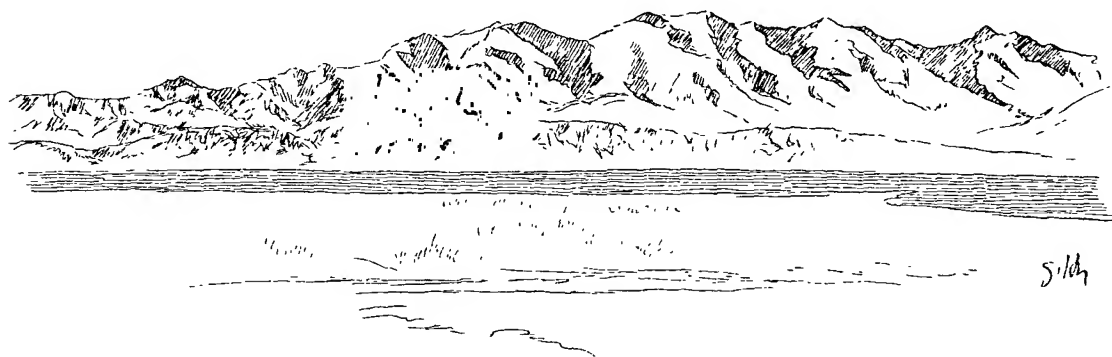


Fig. 463. KURLIK-NOR LOOKING N FROM HLAKIMTO.

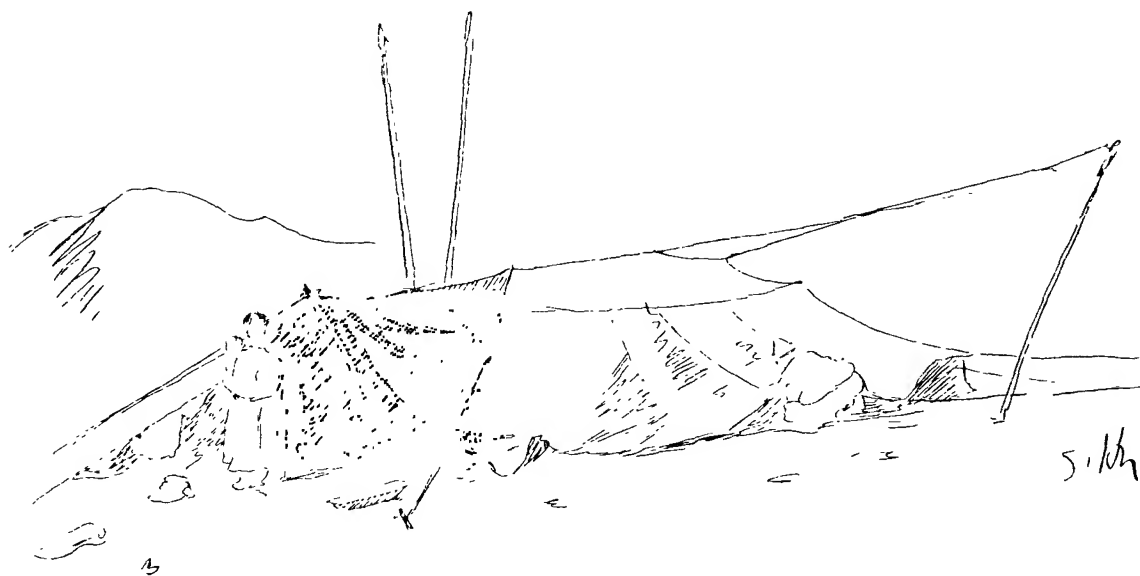


Fig. 464. A TANGUT TENT AT DULAN-JUNG.

October 6th. At first the glen proceeds almost due north, but gradually expands, while the mountains show a tendency to form detached groups. At Ödön-tschelo the glen contracts however to a narrow rocky gateway, spurs on the opposite sides nearly meeting. The rock was a coarse-grained, reddish hornblendic granite. From this point we at length caught sight of the lowlands to the north-



north-east, a straight line in the far, far distance indicating the level expanse of the basin of Tsajdam. Below Ödön-tschelo the glen widens out trumpet-like. The last spurs are detached masses, which appear to spring up out of what looks like perfectly level ground. Both east and west we perceived other, longer spurs of the southern border-range of Tsajdam. At its mouth the bed of the stream is very broad, and old terraces one to two kilometers apart betray where its level once was.



Fig. 465. MOUNTAIN ABOVE THE TSAGAN-NOR; LOOKING NNW AND N.



Fig. 466. LOOKING E FROM DULAN-JUNG.

Soon however even these indications grew indistinct, and the glen debouched upon the steppes and deserts of Tsajdam. The greatly flattened gravelly scree at the foot of the mountain is practically barren; though scanty scrub appeared farther on. At intervals we observed the shallow channels which during the high-water period of summer are excavated in the loose soil by the spreading branches of the river-delta. The next zone that we crossed was characterized by the existence of dunes, though quite tiny, which had gathered behind the shelter of bushes and scrub, forming small ridges that stretched towards the east-south-east; from which it is clear that the last strong wind that blew must have come from the west-north-west. After traversing a final belt, namely of tamarisks, most of them standing on

the customary mounds, we approached the Mongol tent-village of Ike-tsohan-gol, at an altitude of 2763 m.

Here ends the account of my journey through Northern Tibet in 1896. I shall return to it again in the succeeding volume, in the section in which I propose to give a general view of the orography and hypsometry of the Tibetan highlands, and shall then not only analyse the observations which I made in the course of the journey, but also institute a comparison between this magnificent latitudinal valley and others that resemble it, more particularly that in which Wellby and Malcolm travelled. With regard to the continuation of my journey from Ike-tsohan-gol across Tsajdam and alongside the Koko-nor to Si-ning-fu, and finally to Peking, I would beg to refer to my monograph in *Petermanns Mitteilungen*, Ergänzhft No. 131, where also will be found the map prepared and drawn by Dr Hassenstein. Suffice it to say here, that I travelled eastwards along the foot of the southern border-range of Tsajdam, then after fording the Bajin-gol I struck north, and then east again. At the angle I had an opportunity to take a glance at the twin lakes of Kurlik-nor and Tosun-nor, which called vividly to my mind many another pair of linked lakes in Tibet, because one of them contains fresh water, while the other contains salt, and yet both lie close together. The former lake is entered by several tributaries from the northern border-range of Tsajdam, while at its southern end issues the river Holuin-gol, which soon empties itself into the lower lake of Tosun-nor, the water of which is intensely salt. A precisely similar state of things occurs in the combination of the Upper and Lower Kum-köl, as well as in the newly discovered lakes in Eastern Tibet which I have described above. And in vol. IV we shall encounter even more beautiful examples of this lacustrine „twinning” in the region of the Selling-tso, the Naktsong-tso, and the Tschargut-tso, as also in the Tso-ngombo and the Panggong-tso.



Fig. 466. MOUNTAIN AT DULAN-KIT: BETWEEN W AND NNW.

Continuing eastwards beyond the Kurlik-nor, we soon passed several smaller detached lakes — the Chara-nor, Sürche-nor, and Tsagan-nor, the last-named situated not far from the Dulan-kit, which is known from Przhevalskij's journeys. Then, after travelling alongside the Buchain-gol and the northern shore of the Koko-nor, the largest lake in the heart of Asia, — which, I may add, is still awaiting its investigator, who would certainly find himself amply rewarded for his labour — I approached the Chara-kötel, or the Black Pass, for me a very important point, for it was there that I at length turned my backup on the self-contained drainage-basins of Central Asia, in which I had been travelling to and fro for the space of more than three years, and at length entered the true peripheral regions that drain down to the ocean.

But this is not the place to linger longer in these regions, which were relatively well known even before my journey of 1893—97. In the third and fourth volumes of this work we have to deal with no other regions of Central Asia except the Tibetan plateau. After the digression occasioned by my description of the great northern latitudinal valley, we will now resume the thread of the narrative where we dropped it, and in the next volume I will continue my description of the middle parts of Tibet from our headquarters Camp XLIV onwards.

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